Canadian Space Agency

2016–17

Report on Plans and Priorities

The Honourable Navdeep Bains, P.C., M.P.
Minister of Innovation, Science and Economic Development

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Ministers' Message

As Canada begins a new chapter in 2016–17, creating a culture of innovation is more important than ever in driving economic growth.

The recent name change of our Innovation, Science and Economic Development Portfolio recognizes this, placing a deliberate emphasis both on innovation and scientific discovery, and their equal importance for economic development nationally and throughout all of Canada's diverse regions.

We have promised Canadians a government that will bring real change—in both what we do and how we do it. We will invest in growing our economy, increase transparency and use the best evidence available to inform decision making.

Through the programs of the Innovation, Science and Economic Development Portfolio, we will work to develop and deliver an innovation agenda for Canada that will help improve our productivity performance, grow the economy and enhance our prosperity and well-being.

This 2016–17 *Report on Plans and Priorities* of the Canadian Space Agency provides information on how the Agency will support the Government on achieving our agenda in the coming year and we are fully confident that the Canadian Space Agency is prepared to successfully support us and work with our partners inside and outside government to deliver for Canadians. However, given our commitment to more effective reporting, this year's report will be the final submission using the existing reporting framework.

The Prime Minister and the President of the Treasury Board are working to develop new, simplified and more effective reporting processes that will better allow Parliament and Canadians to monitor our Government's progress on delivering real change to Canadians. In the future, the Canadian Space Agency's reports to Parliament will focus more transparently on how we are using our resources to fulfill our commitments and achieve results for Canadians.

The Honourable Navdeep Bains

Minister of Innovation, Science and Economic Development

The Honourable Kirsty Duncan

Minister of Science

The Honourable Bardish Chagger

Minister of Small Business and Tourism

These new reporting mechanisms will allow Canadians to more easily follow our Agency's progress towards delivering on our priorities, which were outlined in the Prime Minister's mandate letters to us.[i]

It is our pleasure to present the *Report on Plans and Priorities* for the Canadian Space Agency for 2016–17, which sets out how the Agency's work will contribute to attaining these shared objectives.

The Honourable Navdeep Bains	The Honourable Kirsty Duncan	The Honourable Bardish Chagger
Minister of Innovation, and Economic Development	Minister of Science	Minister of Small Business Science and Tourism
Mandate Letter[ii]	Mandate Letter[iii]	Mandate Letter[iv]

Section I: Organizational Expenditure Overview

Organizational Profile

Minister of Innovation, Science and Economic Development:
The Honourable Navdeep Bains, P.C., M.P.

Minister of Science:
The Honourable Kirsty Duncan, P.C., M.P.

Minister of Small Business and Tourism:
The Honourable Bardish Chagger, P.C., M.P.

Institutional Head:
Sylvain Laporte, President

Ministerial Portfolio:
Innovation, Science and Economic Development

Enabling Instrument(s):
Canadian Space Agency Act, S.C. 1990, c. 13

Year of Incorporation / Commencement:
Established in March 1989

The Canadian Space Agency was established in 1989. Approximately 90% of its employees are working at the headquarters located at the John H. Chapman Space Centre, in St-Hubert, Quebec. The remaining personnel serve the Agency at the Government Liaison Office and the David Florida Laboratory in Ottawa, with officials in Houston, Washington and Paris.

Organizational Context

Raison d'être

The objects of the Canadian Space Agency[1] (CSA) are *"to promote the peaceful use and development of space, to advance the knowledge of space through science and to ensure that space science and technology provide social and economic benefits for Canadians."*

The CSA is delivering on its mandate in collaboration with Canadian industry, academia, Government of Canada (GoC) organizations, and other international space agencies or organizations.

Responsibilities

The founding legislation that received Royal Assent in 1990 attributed four main functions to the CSA:

- Assist the Minister to coordinate the space policies and programs of the Government of Canada;
- Plan, direct, manage and implement programs and projects relating to scientific or industrial space research and development and the application of space technology;
- Promote the transfer and diffusion of space technology to and throughout Canadian industry; and
- Encourage commercial exploitation of space capabilities, technology, facilities and systems.

[1] To learn more about the mandate of the Canadian Space Agency, go to: http://www.asc-csa.gc.ca/eng/about/mission.asp

Strategic Outcome and Program Alignment Architecture

1. Strategic Outcome: Canada's exploration of space, provision of space services and development of its space capacity meet the nation's needs for scientific knowledge, innovation and information.

- **1.1 Program:** Space Data, Information and Services
  - **1.1.1 Sub-Program:** Earth Orbit Satellite Missions and Technology
    - **1.1.1.1 Sub-Sub-Program:** Earth Observation Missions
    - **1.1.1.2 Sub-Sub-Program:** Communications Missions
    - **1.1.1.3 Sub-Sub-Program:** Scientific Missions
  - **1.1.2 Sub-Program:** Ground Infrastructure
    - **1.1.2.1 Sub-Sub-Program:** Satellite Operations
    - **1.1.2.2 Sub-Sub-Program:** Data Handling
  - **1.1.3 Sub-Program:** Space Data, Imagery and Services Utilization Development
    - **1.1.3.1 Sub-Sub-Program:** Earth Observation Data and Imagery Utilization
    - **1.1.3.2 Sub-Sub-Program:** Communications Services Utilization
    - **1.1.3.3 Sub-Sub-Program:** Scientific Data Utilization
- **1.2 Program:** Space Exploration
  - **1.2.1 Sub-Program:** International Space Station (ISS)
    - **1.2.1.1 Sub-Sub-Program:** International Space Station Assembly and Maintenance Operations
    - **1.2.1.2 Sub-Sub-Program:** International Space Station Utilization
  - **1.2.2 Sub-Program:** Exploration Missions and Technology
    - **1.2.2.1 Sub-Sub-Program:** Space Astronomy Missions
    - **1.2.2.2 Sub-Sub-Program:** Planetary Missions
    - **1.2.2.3 Sub-Sub-Program:** Advanced Exploration Technology Development
  - **1.2.3 Sub-Program:** Human Space Missions and Support
    - **1.2.3.1 Sub-Sub-Program:** Astronaut Training and Missions
    - **1.2.3.2 Sub-Sub-Program:** Operational Space Medicine
    - **1.2.3.3 Sub-Sub-Program:** Health and Life Sciences

1.3 Program: Future Canadian Space Capacity

1.3.1 Sub-Program: Space Expertise and Proficiency

1.3.2 Sub-Program: Space Innovation and Market Access

1.3.2.1 Sub-Sub-Program: International Market Access

1.3.2.2 Sub-Sub-Program: Enabling Technology Development

1.3.3 Sub-Program: Qualifying and Testing Services

1.4 Internal Services

Descriptions of Programs, Sub-Programs and Sub-Sub-Programs are in Section II.

Organizational Priorities

The CSA has singled out one strategic-level priority for each program in order to present a more focused view of its plans and priorities with the Innovation, Science and Economic Development Minister's mandate letter. Many of the 2016–17 ongoing key supportive initiatives have been recast to align with each priority under the planned initiatives section.

Priority: Sustainable Infrastructure for Space-Based Observation

Description

Ensure space-based observation data, including that from the RADARSAT Constellation Mission (RCM), will efficiently meet the public sector's needs and requirements, and supports government plans to foster innovation, science and international collaboration in key areas, including specialized data pertaining to climate change and Canada's natural resources.

Priority Type[2]

Ongoing

Key Supporting Initiatives

Planned Initiatives	Start Date	End Date	Link to Department's Program Alignment Architecture
• Progress with the manufacturing phase of the RCM.	2013	2018	1.1.1.1 Earth Observation Missions
• Develop the Synthetic Aperture Radar (SAR) component of the data policy under the RCM data policy.	2005	2018	1.1.1.1 Earth Observation Missions
• Support the integration of new capabilities offered by RCM into government operations.	2010	2018	1.1.3.1 Earth Observation Data and Imagery Utilization
• Manage access to RADARSAT2 data.	2007	2019	1.1.2.2 Data Handling
• Initiate the development of options with GoC organizations for SAR Data continuity.	2015	2017	1.1.1.1 Earth Observation Missions

2. Type is defined as follows: previously committed to—committed to in the first or second fiscal year prior to the subject year of the report; ongoing—committed to at least three fiscal years prior to the subject year of the report; and new—newly committed to in the reporting year of the RPP or the DPR. If another type that is specific to the department is introduced, an explanation of its meaning must be provided.

• Increase Canada's capacity to detect and track coastal maritime traffic with the Automatic Identification System (AIS) technology by proceeding with the launch of the Maritime Monitoring and Messaging Micro-Satellite (M3MSat).	2008	2018	1.1.1.2 Communications Missions
• Advance Canada's participation in the development of new tools for improved sustainable use of Earth's water resource through the current Surface Water and Ocean Topography (SWOT) mission in partnership with NASA and the French Space Agency (CNES).	2013	2023	1.1.1.3 Scientific Missions

Priority: Fundamental Research and New Discoveries

Description

Meet Canada's obligations towards the International Space Station and position Canada to contribute to new discoveries in upcoming planetary science, space astronomy and human spaceflight missions with the objective of strengthening fundamental research, innovation and technological development.

Priority Type

Ongoing

Key Supporting Initiatives

Planned Initiatives	Start Date	End Date	Link to Department's Program Alignment Architecture
• Meet Canada's obligations towards the International Space Station and its Mobile Servicing Systems (Canadarm2, Dextre and the Mobile Base).	Ongoing	2024	1.2.1.1 International Space Station Assembly and Maintenance Operations
• Continue to work with academia stakeholders to optimize use of Canada's presence on ISS.	Ongoing	2024	1.2.1.2 International Space Station Utilization
• Continue to prepare for the launch and operations of NASA's flagship space observatory James Webb Space Telescope for which Canada is a partner.	Ongoing	2023	1.2.2.1 Space Astronomy Missions

• Deliver the OSIRIS-REx Laser Altimeter (OLA) instrument for the NASA OSIRIS-REx mission. This mission will map the surface of a distant asteroid and bring samples back to Earth.	2013	2024	1.2.2.2 Planetary Missions

Priority: Positioning of the space sector for global opportunities.

Description

Support innovation, science, technology development and capability demonstration in the Canadian space sector to increase their competitiveness and position Canadian industries and universities for future global space opportunities.

Priority Type

Ongoing

Key Supporting Initiatives

Planned Initiatives	Start Date	End Date	Link to Department's Program Alignment Architecture
• Provide space technology development funds and partnership opportunities to industry and academia ensuring that the Canadian space sector becomes more productive, more innovative and more export-oriented.	Ongoing	Ongoing	1.3.1 Space Expertise and Proficiency 1.3.2.2 Enabling Technology Development
• Provide capability demonstration opportunities to the Canadian space sector raising its space readiness in science and technology so it can respond to future space demands emerging either from governments or from the commercial market.	Ongoing	Ongoing	1.3.1 Space Expertise and Proficiency 1.3.2.2 Enabling Technology Development
• Invest an additional $30 million in the ESA satellite communications technology development program.	2015	2017	1.3.2.1 International Market Access

Priority: Getting Results Canadians Deserve

Description

Ensure openness and broad collaboration in the planning, development and implementation of new space policies, strategies and initiatives, and continue to strengthen mechanisms in place to provide clear oversight and accountability in Canada's investments in space.

Priority Type

Ongoing

Key Supporting Initiatives

Planned Initiatives	Start Date	End Date	Link to Department's Program Alignment Architecture
• Continue implementing and improving a whole-of-government approach to managing Canada's space activities.	Ongoing	Ongoing	1.4.1 Management and Oversight
• Continue putting in place streamlined and efficient project management processes.	Ongoing	Ongoing	1.4.1 Management and Oversight
• Continue aligning the CSA's organizational structure to better respond to the Space Policy Framework and government priorities.	Ongoing	Ongoing	1.4.1 Management and Oversight
• Continue with the optimization of resources and excellence in the implementation, oversight and accountability of space-related initiatives that will be the core of the 2017–22 Investment Plan.	Ongoing	2017	1.4.1 Management and Oversight
• Continue to work with space industry leaders and other stakeholders to identify ways in which they can play a stronger leadership role to ensure that the economic value of the government's space investments are fully realized.	Ongoing	Ongoing	1.4.1 Management and Oversight
• Continue to provide secretarial support to the Space Advisory Board in support of its mandate.	Ongoing	Ongoing	1.4.1 Management and Oversight

For more information on ISED's priorities, see the Ministers' mandate letters on the Prime Minister of Canada's website.[v]

Risk Analysis

Key Risks

Risks	Risk Response Strategy	Link to Program Alignment Architecture
Cost increase Because of unexpected technological challenges, changing requirements or delays in project implementation, there is a risk that actual project costs may be higher than estimated costs, including the risk margins. This could compel the CSA to reconsider priorities.	– Reduce technological uncertainty by implementing technology development activities early in the project. – Assess projects' risks and allocate a financial margin based on the risks' impact and probability levels; – Implement improved project management methodology; and – Where applicable, implement acquisition strategies based on risk sharing with industry partners.	1.1.1 Earth Orbit Satellite Missions and Technology 1.1.2 Ground Infrastructure 1.2.1 International Space Station (ISS) 1.2.2 Exploration Missions and Technology
Space sector capacity Canada's space sector capacity may be at risk in the face of the arrival of new players, uncertain investment levels and potential technology development issues. A decrease in this capacity could make it insufficient to meet Canada's future requirements, including necessary partnerships for maintaining Canada's position in the space exploration field.	– Continuous updating of Canadian space technology capacity requirements; – Promotion by the CSA of partnerships between the Canadian private sector and the academic community; – Ongoing monitoring and reporting on Canadian space sector conditions; and – Continued partnerships with foreign space agencies, academia and industry with the objective of creating participation opportunities in international missions.	1.1.3 Space Data Imagery and Services Utilization Development 1.2.2 Exploration Missions and Technology 1.3.1 Space Expertise and Proficiency 1.3.2 Space Innovation and Market Access

Risks	Risk Response Strategy	Link to Program Alignment Architecture
Gap between stakeholders' expectations and CSA's provision of products and services Because of possible interruption of missions in progress, insufficiency of infrastructures or personnel in place, delays in project implementation or changes in stakeholders' requirements and priorities, there is a risk of a gap between the partners' expectations and the data and services provided by the CSA; this may affect the achievement of expected outcomes.	– Ongoing consultations with federal departments and the academic community regarding long-term requirements; – Ongoing consultations during preliminary project phases regarding operational requirements; – Exploration of small satellite development capabilities with the objective of providing timely and more efficient space solutions; – Optimal management of the allocation of RADARSAT-2 data portion of the Government of Canada's credit to ensure all federal government users' needs are met within the constraints of the overall allocation; – Monitoring of space objects and taking collision-avoidance measures in order to minimize the risk of serious damage to the RADARSAT-2 spacecraft; and – Annual updating of the Integrated Human Resources Plan.	1.1.1 Earth Orbit Satellite Missions and Technology 1.1.2 Ground Infrastructure 1.2.1 International Space Station (ISS) 1.3.3 Qualifying and Testing Services
Financial resource management Because of increase project cost, a higher share of funding allocated to operations or deficiencies in governance mechanisms, there is a risk that the funds available for new initiatives may be insufficient or that the choice of investments may be inappropriate. This may mean that existing infrastructure or R&D investments may not be able to meet Canada's future space requirements.	– Consideration of synergies between available resources and equipment, and new mission options; – Continuous monitoring of operating costs; – Creation of natural fit partnerships and operational cost sharing; – Regular monitoring of the project portfolio, activity plans and schedules; – Regular monitoring of financial management strategies; and – management strategies; and – Implementation of the new Integrated Governance and Monitoring Framework.	1.1.1 Earth Orbit Satellite Missions and Technology 1.1.2 Ground Infrastructure 1.2.2 Exploration Missions and Technology 1.3.2 Space Innovation and Market Access

Risk Narrative

As depicted in the 2014–15 Departmental Performance Report (DPR), many departments rely on space-based data to deliver their mandate and many others expect to do so in the near future. In a rapidly evolving context, with various needs and long-term timeframe to develop space assets, there is a risk that gaps will occur between services provided and the services needed by the users. To mitigate that risk, the CSA will support the development of small satellites technology which will provide timely and cost effective responses to government needs while continuing the management and optimization of RADARSAT-2 data allocation until the RADARSAT Constellation Mission is launched in 2018. In addition, the CSA's interdepartmental governance approach will help to identify and, in some cases, close the gaps between supply and demand.

Additionally at the industry level, the majority of space companies are small, which limits their ability to export products and services worldwide. The Canadian space sector, especially small and medium enterprises, remains reliant on continued research and development investments to increase existing growth opportunities and seek new ones. To avoid missing opportunities to join international space projects, and with the objective of addressing future national needs and priorities, the CSA will work with Canadian industry and academic stakeholders to identify ways by which they can better demonstrate their capabilities and play a leadership role. While developing and seeking new opportunities, the CSA will continue to advance space robotics, optics, satellite communications, and space-based radar and other key technologies, in order to maintain Canada's current competitive edge.

Finally, implementation and technical challenges associated with space missions continue to represent another major source of risk. The international aspect of some projects may add to these challenges. This can lead to scheduling issues and cost increases. In order to mitigate these risks, the CSA will continue with the implementation of improved governance, streamlined and efficient project management processes and financial monitoring tools. These initiatives will also allow CSA to track and report on the progress of its commitments, assess the effectiveness of its work, and align its resources with priorities, in order to get the results we want and Canadians deserve.

Planned Expenditures

Budgetary Financial Resources (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
432,394,821	432,394,821	338,671,567	330,035,295

Refer to sub-sub-programs for details on significant planned spending variation.

Human Resources (Full-time equivalents—FTEs)

2016–17	2017–18	2018–19
619.0	620.6	620.7

Notes: There is no correlation between the annual fluctuations of the budget and the number of full-time equivalents. The budget variations are mainly due to the projects' development cycles and their associated cash flow requirements (re-profiling + additional funds for RCM). Consequently, these do not entail any adjustment on the annual number of full-time equivalents under the CSA A-Base budget. Students are now included in the FTE calculation.

Budgetary Planning Summary for Strategic Outcome and Programs (dollars)

Strategic Outcome, Programs and Internal Services	2013–14 Expenditures	2014–15 Expenditures	2015–16 Forecast Spending	2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
Strategic Outcome: Canada's exploration of space, provision of space services and development of its space capacity meet the nation's needs for scientific knowledge, innovation and information.							
Space Data, Information and services	207,544,469	175,496,334	202,039,538	215,086,172	215,086,172	122,494,062	128,068,227
Space Exploration	96,501,810	97,329,795	96,394,372	99,437,361	99,437,361	99,827,265	88,888,616
Future Canadian Space Capacity	55,453,614	58,018,955	65,420,778	66,094,200	66,094,200	65,800,960	67,060,502
Subtotal	359,499,893	330,845,084	363,854,688	380,617,733	380,617,733	288,122,287	284,017,345
Internal Services Subtotal	49,215,347	45,245,854	46,454,732	51,777,088	51,777,088	50,549,280	46,017,950
Total	408,715,240	376,090,938	410,309,420	432,394,821	432,394,821	338,671,567	330,035,295

CSA's expenditure profile variation since FY 2013–14 is primarily the result of investments to develop the RADARSAT Constellation Mission (RCM) as announced in Budget 2010. CSA has received additional funding from other government departments in order to complete the RCM funding profile. More information is provided in the section "Departmental Spending Trend" shown below.

The funding profiles of CSA's projects and missions vary from year to year and therefore have an impact on the Expenditures, the Forecast Spending as well as the Planned Spending by Program. These variations are presented in the table "Budgetary Planning Summary for Strategic Outcome and Programs (dollars)" shown above.

Alignment of Spending With the Whole-of-Government Framework

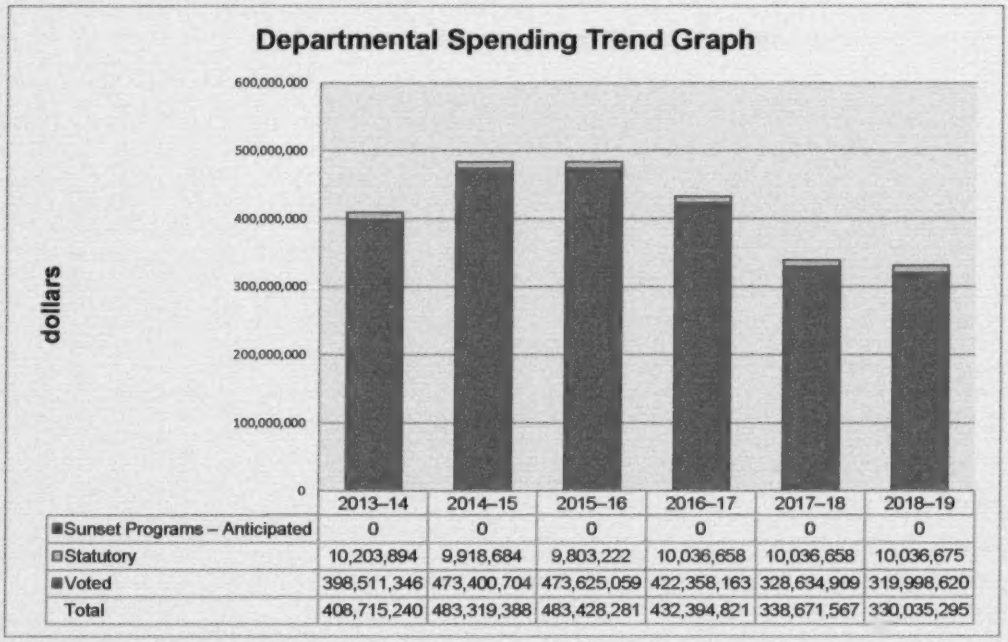
Alignment of 2016–17 Planned Spending With the Whole-of-Government Framework[vi] (dollars)

Strategic Outcome: Canada's exploration of space, provision of space services and development of its space capacity meet the nation's needs for scientific knowledge, innovation and information.			
Program	**Spending Area**	**Government of Canada Outcome**	**2016–17 Panned Spending**
1.1 Space Data, Information and services	Government Affairs	Well–managed and efficient government operations	215,086,172
1.2 Space Exploration	Economic Affairs	An innovative and knowledge–based economy	99,437,361
1.3 Future Canadian Space Capacity	Economic Affairs	An innovative and knowledge–base economy	66,094,200

Total Planned Spending by Spending Area (dollars)

Spending Area	Total Planned Spending
Economic Affairs	165,531,561
Social Affairs	0
International Affairs	0
Government Affairs	215,086,072

Departmental Spending Trend



	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19
Sunset Programs – Anticipated	0	0	0	0	0	0
Statutory	10,203,894	9,918,684	9,803,222	10,036,658	10,036,658	10,036,675
Voted	398,511,346	473,400,704	473,625,059	422,358,163	328,634,909	319,998,620
Total	408,715,240	483,319,388	483,428,281	432,394,821	338,671,567	330,035,295

CSA's annual A-Base budget of $300 million was approved in Budget 1999 and is now of the order of $260 million. The difference in the spending trend shown above is mainly attributable to the following factors:

- The cumulative impact of re-profiling funds resulting from sound management of high-risk projects and programs (e.g. high technology risks, long-term development cycle, uncertainties with work schedules, implementation delays).

- Budget 2010 allocated $397 million to the CSA over five years (FY 2010–11 to FY 2014–15) to develop the RADARSAT Constellation Mission (RCM). An additional $374.2 million over six years (FY 2013–14 to FY 2018–19) was allocated for RCM. $140.0 million was new funding from the Fiscal Framework and $234.2 million was transferred from other government departments to CSA.

- The CSA's contribution to the Budget 2012 Strategic Operating Review was $24.7 million for FY 2013–14 and ongoing $29.5 million starting FY 2014–15.

- Additional funding and expenditure authority of $12.0 million was authorized during FY 2014–15 for two years (FY 2014–15 and 2015–16) in order to provide enhanced space-based Automatic Identification System (AIS) data services.

- Additional funding and expenditure authority of $7.9 million over two years (FY 2015–16 and FY 2016–17) was authorized for the Maritime Monitoring and Messaging Micro-Satellite (M3MSat) project due to the increased cost of the launch provider and associated launch delay.

- Additional funding of $9.9 million over two years (FY 2015–16 and FY 2016–17) was authorized to perform accelerated infrastructure upgrades and repairs at the David Florida Laboratory in line with the 2014 Economic Action Plan - Federal Infrastructure announcements.

- Additional funding of $9.5 million through the re-profiling of funds from the Fiscal Framework to FY 2016–17 was authorized for the provision of value-added satellite reports/images for humanitarian needs.

Estimates by Vote

For information on CSA's organizational appropriations, consult the *2016–17 Main Estimates.*[vii]

Section II: Analysis of Programs by Strategic Outcome

Strategic Outcome:

Canada's exploration of space, provision of space services and development of its space capacity meet the nation's needs for scientific knowledge, innovation and information.

Program 1.1: Space Data, Information and Services

Description

This Program includes the provision of space-based solutions (data, information and services) and the progression of their utilization. It also serves to install and run ground infrastructure that processes the data and operates satellites. This Program utilizes space-based solutions to assist Government of Canada (GoC) organizations in delivering growing, diversified or cost-effective programs and services within their mandate, which is related to key national priorities, such as sovereignty, defence, safety and security, resource management, environmental monitoring and the North. It also provides academia with data required to perform its own research.

The services delivered through this Program are rendered, and the data and information are generated and processed, with the participation of the Canadian space industry, academia, GoC organizations, national and international organizations, such as: foreign space agencies, not-for-profit organizations, as well as provincial and municipal governments. This collaborative effort is formalized under national and international partnership agreements, contracts. This Program is also funded through the Class Grant and Contribution Program.

Budgetary Financial Resources (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
215,086,172	215,086,172	122,494,062	128,068,227

Refer to sub-sub-programs for details on significant planned spending variation.

Human Resources (Full-Time Equivalents [FTEs])

2016–17	2017–18	2018–19
103.1	102.7	102.0

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. GoC organizations offer more diversified or cost- effective programs and services due to their utilization of space-based solutions.	1. Number of new GoCs programs offering more diversified or efficient services.	1

Planning Highlights

CSA's activities encompass concept and feasibility studies, space missions and programs, and applications development, all necessary to the delivery of useful space-based information that will assist the Government of Canada meet its priorities. The effect of these activities on Expected Results is long term because of the time required from the inception of innovative ideas to the integration of space-based data into operational products supporting Government services. In FY 2016–17, it is expected that an additional Government program will benefit from the operational use of EO. This will add to the 37 GoC Programs already using CSA enabled EO data (see Sub-sub-program 1.1.1). More programs are expected to come on stream in future years. The new program is the National Terrestrial Ecosystem Monitoring System which will enable the Canadian Forest Service of NRCan to use EO satellite data to characterize terrestrial ecosystems to support monitoring, reporting, and policy development objectives. It is the outcome of many years of effort in partnership with CSA, Agriculture and Agri-Food Canada, Statistics Canada, and Environment Canada to develop the capacity to integrate data from a variety of sensors (including RADARSAT-2 and European Union's Sentinel-2) to create new information regarding the status, composition, and dynamics of Canada's various terrestrial ecosystems.

In line with Canada's Space Policy Framework and government priorities, CSA will continue to support economic development and scientific research in Canada and to develop a strong strategic plan to support sound, evidence-based decision-making and efficient government services, leading to economic benefits for all of society. In doing so, CSA will continue to:

- Support the implementation phase of RADARSAT Constellation Mission (RCM) and related integrated activities into government operations;
- Support a strong interdepartmental governance of space-related files, including providing support to the development of the Government of Canada Earth Observation Strategy;
- Participate in international fora and develop key partnerships that support its Space Data, Information and Services mandate; and
- Stay abreast of the latest trends and innovation in Earth Observation (EO), Satellite Communications, Navigation and Space Weather technologies.

In FY 2016–17, the CSA will invest strategically in innovative EO concepts for agriculture, natural resources exploitation, climate modeling and furthering the understanding of greenhouse gases and air quality in the North.

Sub-Program 1.1.1: Earth Orbit Satellite Missions and Technology

Description

This Sub-Program encompasses the development of complete Canadian satellite systems or of sub-systems, payloads, instruments or other components provided to domestic and foreign satellites. This Sub-Program also includes the development of advanced technologies that could shape or determine the nature of potential new Earth orbit satellite missions. This Sub-Program is necessary because Government of Canada (GoC) organizations use satellite-generated data, information and services to deliver their mandate; and so do academia to perform their research.

This Sub-Program is delivered in collaboration with GoC organizations, along with the participation of Canadian industry, academia and foreign space agencies. This collaborative effort is formalized under contracts, grants, contributions and partnership agreements with national, public/private and international organizations.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
192,962,272	100,880,874	106,894,855

Human Resources (FTEs)

2016–17	2017–18	2018–19
77.7	73.8	80.4

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. GoC organizations are using satellite generated space-based data to deliver their mandate.	1. Number of GoC's programs using CSA-enabled Earth observation data or derived information to deliver their mandate.	37
	2. Percentage of RADARSAT data used in the delivery of GoC operational programs.	60%

Planning Highlights

All the activities under this sub-program are aimed at providing needed data or researching additional information sources that will eventually lead to new or more cost effective solutions to the delivery of GoC departments' mandates.

A number of departments are now using RADARSAT-2 data operationally to achieve their mandates. In many cases CSA supports departments by co-funding the development of their applications. Examples of applications are:

- The Integrated Satellite Tracking of Pollution (ISTOP) program which uses satellite imagery to monitor ocean waters and provide a fast response to the problem of pollution.
- The SARWind project which is the result of a joint partnership with industry and allows Environment Canada's Meteorological Services to improve their wind analysis and short-term maritime forecasts, especially in coastal areas.
- Ecological monitoring in national parks by Parks Canada; mapping of northern regions by Natural Resources Canada; flood mapping by Public Safety Canada.

CSA will continue working with Government departments to:

- enhance their capability to use Earth Observation (EO) data;
- facilitate and secure access to needed EO data to ensure program and service delivery; and
- support science, research and development activities for potential new applications.

SCISAT and OSIRIS measurements are used by Environment Canada in the ongoing effort to improve climate models, to monitor the evolution of the ozone layer and to improve Air Quality and UV Index forecasts. MOPITT measurements are used by Environment Canada in development of the Carbon Assimilation System. CloudSat data are used by Environment Canada in improving weather and climate models.

Observations from the European Commission's Copernicus Program are also used to help deliver the mandates of the Government of Canada programs. Data from the Sentinel-1 satellite already

support ice monitoring in Environment Canada. In FY 2016–17, Sentinel-2 and Sentinel-3 will also be used to support key services rendered by the Government such as crop monitoring; land cover and snow cover mapping; and ocean color, which is a key marker for climate change and water quality.

An estimated 60% of RADARSAT data used by 37 government programs are for operational purposes. The remaining 40% will be used for Research and Development purposes.

Sub-Sub-Program 1.1.1.1: Earth Observation Missions

Description

This Sub-Sub-Program encompasses the definition, design, technology development, and implementation of Earth orbit satellites dedicated to producing data, information or imagery of Earth and its atmosphere, ranging from its sub-surface to its upper atmospheric layers, including space surveillance for asteroids, earth orbiting objects and space debris. This Sub-Sub-Program serves continuous operations and is necessary to produce pertinent Earth Observation data and imagery that assist with the mandate delivery of Government of Canada (GoC) organizations that deal especially with key national priorities, such as environment, climate change, weather, natural resources, sovereignty, defence, safety and security. It also provides academia with data required for its research.

This Sub-Sub-Program is delivered in collaboration with GoC organizations, along with the participation of Canadian industry, academia and foreign space agencies. This collaborative effort is formalized under contracts and partnership agreements with national, public/private and international organizations. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
183,401,804	94,805,118	101,208,779

Human Resources (FTEs)

2016–17	2017–18	2018–19
68.7	64.7	71.1

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Earth observation missions provide GoC organizations and research institutions with data and information.	1. Number of GoC programs provided with CSA-enabled data and images from Earth observation missions.	42
	2. Number of research institutions provided with CSA-enabled data and images from Earth observation missions.	15
	3. Number of CSA-enabled Earth observation data users.	70

Planning Highlights

Since the launch of the RADARSAT-1 Earth observation satellite, the first Canadian Space-Based Synthetic Aperture Radar (SAR), a growing number of programs and services have been developed, and more government departments have become dependent on a reliable supply of SAR data for the effective delivery of their mandates and services. The CSA will continue to ensure continuity of the provision of Space-based Synthetic Aperture Radar (SAR) data by:

- managing the Government of Canada RADARSAT-2 data allocation effectively, and maintaining the RADARSAT-1 archives (1.1.2.1);
- continuing the implementation of RADARSAT Constellation Mission (RCM), the follow-on to RADARSAT-2. Major milestones that are expected to be achieved during FY 2016–17 include completion of the first satellite, completion of all of the individual Ground Segment subsystems and completion of all Government Furnished Equipment in anticipation of the planned launch in 2018. More information on this major initiative can be found in the Supplementary Information Tables[viii];
- investing in studies and concepts to provide users with a sustained source of SAR data for the generation of systems post-RCM;
- continuing to lead the development of a policy governing access, sharing and use of RCM SAR data;
- supporting the integration of new capabilities offered by RCM data into government programs and services; and
- investigating the best approach to ensure continuity in data and operational space services to meet Government needs. This work includes the conduct of a feasibility study for a follow-on mission to RCM.

In FY 2016–17, at least 42 GoC programs will be provided with CSA-enabled data and images from Earth observation (EO) missions for R&D and/or operational purposes. In total, 70 active

users will receive RADARSAT-2 data. Moreover, through the Science and Operational Applications Research (SOAR) Program, CSA and its partners will provide the opportunity to access RADARSAT-2 data for research and testing purposes to 15 research institutions.

Sub-Sub-Program 1.1.1.2: Communications Missions

Description

This Sub-Sub-Program encompasses the definition, design, technology development, and implementation of Earth orbit satellites dedicated to delivering continuous communications, including Navigation, Positioning and Timing (NPT) services. This Sub-Sub- Program serves continuous operations and is necessary to provide pertinent communications and NPT services that assist Government of Canada (GoC) organizations in the delivery of their mandate, particularly those locating and monitoring vehicle or ship signals, those dealing with remote communities or those managing other key national priorities, such as sovereignty, defence, safety and security.

This Sub-Sub-Program is delivered in collaboration with GoC organizations, along with the participation of Canadian industry, academia and foreign space agencies. This collaborative effort is formalized under contracts and partnership agreements with national, public/private and international organizations. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
5,672,100	1,022,496	828,816

Human Resources (FTEs)

2016–17	2017–18	2018–19
7.3	7.3	7.5

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Satellites provide communications services that respond to the expressed needs of GoC organizations.	1. Number of satellite communication missions/instruments in operation.	1
	2. Number of GoC organizations using data from satellite communication missions.	1

Planning Highlights

In partnership with the Department of National Defence (DND), the CSA will continue to support maritime domain awareness with the operations of Maritime Monitoring and Messaging Microsatellite (M3MSat). This joint micro-satellite project aims to optimize the Automatic Identification System (AIS) payload in maritime traffic identification and significantly support Canadian industry's business development strategies. It will also demonstrate and further develop a multi-mission micro-sat bus capability. The data from this satellite, which is scheduled for launch in the second quarter of 2016, will support DND's Polar Epsilon program. DND will be the main user department for AIS data produced by M3MSat.

Sub-Sub-Program 1.1.1.3: Scientific Missions

Description

This Sub-Sub-Program encompasses the definition, design, technology development, and implementation of Earth orbit satellites dedicated to producing scientific data and information for research performed by Government of Canada (GoC) organizations or academia. Examples of this research are those pertaining to climate processes and space weather (solar winds and their interaction with the Earth's magnetic field). This Sub-Sub-Program is necessary to produce pertinent scientific data and information that allow GoC organizations to mitigate damage or avoid the disabling of critical ground and space infrastructure, such as pipelines, electricity networks and satellites that can sustain damage from the effects of solar winds. In addition, with their enhanced understanding of climate processes and the improved models made possible through this Sub-Sub-Program, GoC organizations are better able to provide weather and climate forecasting. Academia also uses the data and information produced through this Sub-Sub-Program to perform its own research.

This Sub-Sub-Program is delivered in collaboration with GoC organizations, along with the participation of Canadian industry, academia and foreign space agencies. This collaborative effort is formalized under contracts and partnership agreements with national, public/private and

international organizations. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
3,888,368	5,053,260	4,857,260

Human Resources (FTEs)

2016–17	2017–18	2018–19
1.7	1.8	1.8

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Sun-Earth system scientific space missions reflect GoC organizations and research institutions priorities.	1. Number of Sun-Earth system scientific missions/instruments in operation.	20
	2. Number of Canadian and international organizations participating in CSA's Sun-Earth system science missions.	130

Planning Highlights

In FY 2016–17, the CSA will continue to support 20 scientific missions and instruments in operation. The missions and the extent of CSA's support are described in sub-sub-programs 1.1.2.2 and 1.1.3.3. One hundred and thirty Canadian and international organizations are expected to benefit from those data. These activities contribute directly to research efforts by academia and GoC organizations in support of the development of future services or to answer science questions that, in turn, allow for the development and improvement of theoretical models.

The CSA will continue to support the development of the Canadian contribution to the NASA-CNES Surface Water and Ocean Topography (SWOT) Mission. The SWOT mission, scheduled to launch in 2020, will monitor and measure water heights of rivers, lakes and flooded zones as well as ocean currents. SWOT data will be of great utility to Environment Canada for hydrological and meteorological monitoring and forecasting, and to Fisheries and Oceans Canada for ocean science and forecasting. Detailed design work is planned to be complete by March 2017.

Sub-Program 1.1.2: Ground Infrastructure

Description

This Sub-Program includes the development, installation and use of an integrated and coordinated national system of ground infrastructure to receive data from domestic or foreign satellites. In addition, the ground infrastructure houses and uses the equipment required for satellite operations. This Sub-Program is necessary to operate satellites as well as to process and make available space-based data received by the Canadian Space Agency to assist Government of Canada (GoC) organizations in delivering their mandate. Finally, this Sub-Program capitalizes on Canada's geographical advantage by capturing space data from the increasing number of satellites flying over the Arctic and by installing ground stations in this strategic location.

This Sub-Program is delivered with the participation of industry, GoC organizations and foreign space agencies. This collaborative effort is formalized under contracts, grants, contributions and partnership agreements with national, public/private and international organizations.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
10,957,596	10,892,884	10,512,068

Human Resources (FTEs)

2016–17	2017–18	2018–19
19.4	22.9	15.6

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Expressed Canadian and foreign data needs are fulfilled by ground infrastructure.	1. Percentage of acquisitions request fulfilled.	RADARSAT-2 80% SCISAT-1 95% NEOSSat 50% M3MSat 70%
	2. Ratio of acquisitions request fulfilled to missions acquisition requirements.	RADARSAT-2 80% SCISAT-1 95% NEOSSat 50% M3MSat 95%
2. National ground infrastructure is reliable.	1. Percentage of successful satellite contacts.	95%

Planning Highlights

The CSA is committed to the planning, maintenance and operation of a reliable and efficient ground infrastructure for multi-mission operations.

While maintaining the current infrastructure, CSA is also manufacturing the ground segment installations for the future RCM. The Primary Control Facility for RCM, from which the satellites will be controlled and operated is planned to be built in FY 2016–17.

The Targets for the missions indicated above, vary because of different system characteristics and stages of operational maturity.

The 3rd indicator measures the availability of the Ground Segment which is a measure of its readiness for mission operations when it is required.

Sub-Sub-Program 1.1.2.1: Satellite Operations

Description

This Sub-Sub-Program encompasses the Telemetry, Tracking and Command (TT&C) of Canadian satellites or of foreign satellites when such services are required from Canadian stations. It also includes the development, installation and use of ground infrastructure that processes the data and operates satellites. This Sub-Sub-Program is necessary to render orbiting satellites functional.

The operations of Canadian Space Agency (CSA) satellites are mostly conducted with CSA equipment located in Canada. In some instances, formal arrangements can be concluded between CSA, Canadian industry, Government of Canada (GoC) organizations or international partners to operate one party's satellites using another party's equipment. Those arrangements can also provide for the location of one party's equipment in another party's facilities.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
5,997,564	6,563,032	6,856,300

Human Resources (FTEs)

2016–17	2017–18	2018–19
14.7	18.7	11.6

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. The CSA's satellites are functioning as per operational requirements.	1. Percentage of space system availability.	SCISAT 90% NEOSSat 80% M3MSat 70%
	2. Number of Canadian satellites operated by the CSA, as per operational requirements.	3
2. Foreign satellite missions are supported.	1. Number of foreign satellites supported by ground infrastructure operations.	3 LEOP[3] and maintenance support

Planning Highlights

The CSA will continue to ensure ground infrastructure required for three Canadian satellites (SCISAT-1, NEOSSat, and M3MSat) remain functional and that support to foreign missions will be provided as requested.

The CSA will continue to operate the Canadian satellite, SCISAT-1, launched in 2003. The original mission design was for two years, thus it is surpassing its design life by 12 years. The satellite still provides reliable data to scientists on the ozone layer, and maintains an availability of 90%.

The Near Earth Object Surveillance Satellite (NEOSSat) was launched in February 2013. NEOSSat is a microsatellite jointly sponsored by CSA and Defense Research and Development Canada (DRDC) to acquire data on near-Earth-orbiting objects (asteroids and man-made objects such as spacecraft and space debris). The operations of NEOSSat are planned to continue next year with the same availability as last year (80%).

M3MSat, expected to launch in April, 2016. After a period of commissioning, it will start operations. Target availability is 70%.

In FY 2016–17, CSA will also provide access to Canadian ground infrastructure for foreign satellites missions, allowing foreign space agency partners to control their satellites when flying over Canada. Satellites from France and Germany are among those the CSA is planning to support.

[3] LEOP: Launch and early orbit phase.

Sub-Sub-Program 1.1.2.2: Data Handling

Description

This Sub-Sub-Program includes a coordinated national approach to determine optimal station locations and space data handling. This Sub-Sub-Program is necessary for the planning and tasking of data acquisition, as well as the capture, calibration, cataloguing, archiving and availability of space data received from domestic or foreign satellites to assist Government of Canada (GoC) organizations in delivering their mandate.

Data handling operations are mostly conducted with Canadian Space Agency (CSA) equipment, located in its ground facilities. In some instances, formal arrangements can be concluded between CSA, GoC organizations or international partners to use another party's equipment located within its facilities. This Sub-Sub-Program is delivered with the participation of Canadian industry, foreign space agencies and GoC organizations. This collaborative effort is formalized under contracts and partnership agreements with national, public/private and international organizations. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
4,960,032	4,329,852	3,655,768

Human Resources (FTEs)

2016–17	2017–18	2018–19
4.7	4.2	4.0

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Satellite data are provided to GoC organizations and research institutions.	1. Number of RADARSAT-2 images delivered to GoC organizations and other customers.	24,000
	2. Number of validated and used instruments in Sun-Earth system science.	21
	3. Number of RADARSAT-1 archived images delivered to GoC and other customers.	100

Planning Highlights

The CSA will continue managing the RADARSAT-2 data allocation to ensure the needs of operational Government users are met in a sustainable way. In FY 2016–17, government users are planning to use 24,000 images, maintaining the rate of consumption of the previous years.

In compliance with Canada's Open Government Strategy, the CSA will ensure that RADARSAT-1 data archives are maintained, and will continue supplying SAR data to the existing client base. RADARSAT-1 data archives are an important asset and provide a source of unique reference data for operational and research purposes.

The CSA also supports scientists to operate instruments, process data and validate and distribute data products. Examples include:

- Support scientists to monitor the atmosphere as it responds to natural and man-made changes, and to improve climate and weather models, by operating SCISAT-1 and supporting data production, validation and analysis. SCISAT-1 provides climate-quality measurements of atmospheric composition in thin layers from cloud-top to 100 km.
- Support to MOPITT and OSIRIS, two major Canadian science instruments are currently orbiting Earth and collecting atmospheric composition data. MOPITT, on NASA's Terra satellite, measures pollutants in the troposphere. OSIRIS, on the Swedish Odin satellite, measures ozone and aerosols in the stratosphere, providing important data for monitoring trends, and assessing the status of the ozone layer and for improving climate models.
- Support acquisition of observations by the Geospace Observatory (GO) network of instruments located across Canada. These instruments make observations of the upper atmosphere, ionosphere, aurora borealis and magnetosphere in the near-Earth space environment (geospace) above Canada. This provides a better understanding of the phenomena of space weather. Canada is the preferred location for studying space weather processes due to its proximity to the magnetic North Pole and its large northern landmass.
- Support to Canadian university scientists in research using data from the Canadian Electric Field Instrument (EFI) on board the ESA Swarm mission. Launched in November 2013, Swarm is primarily a magnetic surveying mission. Canadian scientists will use the EFI data, in conjunction with Geospace Observatory Canadian ground instruments, to help understand ionospheric plasma convection processes.

Sub-Program 1.1.3: Space Data, Imagery and Services Utilization Development

Description

This Sub-Program develops utilization of space-based data, imagery and information, and of communications services available on space assets for the benefit of the user community, primarily Government of Canada (GoC) organizations and academia. This Sub-Program is necessary to foster the development of a Canadian value-added industry that turns space data and information into readily useable products, as well as to increase the ability of GoC organizations to use space-based solutions (data, information and services) for the delivery of their mandate and to increase the ability of academia to perform their research.

This Sub-Program engages the participation of the Canadian space industry and academia and is formalized under contracts and partnership agreements with national, public/private and international organizations.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
11,166,304	10,720,304	10,661,304

Human Resources (FTEs)

2016–17	2017–18	2018–19
6.0	6.0	6.0

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. GoC organizations are using space-based solutions to deliver their mandate.	1. Number of GoCs programs using developed applications to deliver their mandate.	14
	2. Average number of GoC programs using each developed applications.	3

Planning Highlights

Space provides a unique vantage point to view the Earth. Satellites provide accurate measurements with broad coverage over long periods of time. However, it is only when those measurements are turned into products and services that societal and economic values are actualized. Government use of space-based data to render more efficient and innovative services,

to support decision making and policy development requires investments, qualified personnel and long-term planning.

Because it usually takes years between the first applications development using space data until the full integration of these applications into the operations of a department, CSA has the important mandate to support both the users and the developers throughout the development.

In FY 2016–17, through the interdepartmental governance approach, the CSA will gather government departments and take into consideration their needs, experiences and level of preparation. The CSA will work with other government departments to ensure that the use of space based data becomes an integral part of their departmental planning and ongoing budgets.

Continuing to develop products and applications using the RADARSAT-2 data and CSA supported missions such as Sentinel, and developing capacity to use the upcoming RCM data remain a priority. The integrated management of those efforts also allows having more departments benefitting from the CSA's investments in the development of new information products and services generated from the space infrastructure. In FY 2016–17, CSA expects to have 14 federal government programs using space-based applications to deliver their mandates. It is expected that an average of three programs will use each developed application.

The CSA will continue to leverage partnership opportunities and international efforts to access foreign data and build expertise in order to better serve Canadians. Among the many initiatives, are the European Commission's Copernicus Program, the International Charter-Space and Major Disasters, the Committee on Earth Observation Satellites (CEOS) and the Polar Space Task Group.

Sub-Sub-Program 1.1.3.1: Earth Observation Data and Imagery Utilization

Description

This Sub-Sub-Program develops the utilization of Earth observation imagery and atmospheric data acquired from Canadian and foreign space assets, ranging from its subsurface to its upper atmospheric layers. This also applies to weather and climate imagery. This Sub-Sub-Program is necessary to broaden the applicability of currently available Earth observation space products and services (optimization) or to create new ones (innovation) for the user community (Government of Canada [GoC] organizations and academia).

This Sub-Sub-Program engages the participation of the Canadian space industry and academia and is formalized under contracts and partnership agreements with national, public/private and international organizations. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
9,483,404	9,457,404	9,398,404

Human Resources (FTEs)

2016–17	2017–18	2018–19
5.3	5.3	5.3

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. The ability of GoC organizations, research institutions and industry to turn Earth Observation data into useable products and services, is enhanced.	1. Number of Earth Observation applications developed.	35 EOADP 10 GRIP 5 SOAR 20
	2. Number of CSA-enabled peer-reviewed papers related to data utilization produced in research institutions and R&D community in Canada.	10

Planning Highlights

The CSA will continue to encourage the growth of societal and economic benefits from the use of space-based EO data. CSA applications development programs strengthen the ability of governments and other stakeholders to incorporate Earth observations into their regular activities. These programs develop the capacity of government users, value-added industry and academia to develop their own products and services using space-based data such as RADARSAT-2.

The Government-Related Initiatives Program (GRIP) co-finances government users who wish to invest in using the capabilities of RADARSAT-2 and other CSA supported missions, to bring their current applications closer to an operational status or to find ways to improve the use of the data. In FY 2016–17, 5 applications are planned to be developed, adding to the 30 already developed in 14 departments with this very successful program. Priority areas are those identified by the RADARSAT Constellation Mission and by departments (ecosystems, disaster management, security and sovereignty, water management and northern development).

Through the Science and Operational Applications Research (SOAR) Program, the CSA supports Canadian universities and post-secondary educational institutions in using RADARSAT-2 data for projects oriented predominantly towards fundamental and applied research in the development of EO applications. By supporting these projects CSA fosters the development of a critical mass of researchers and highly qualified people in Canada in the field of SAR Earth observation.

The Earth Observation Application Development Program (EOADP) supports the capacity development of the value-added industry. In FY 2016–17, the EOADP will support 16 on-going EO research and development projects, of which 10 will lead to developed applications during the year. In addition the CSA has consulted government departments interested in using the information from Space-based Automatic Identification Systems (S-AIS) and, in FY 2016–17, will support up to five studies aimed at developing concepts and plans to improve the monitoring of vessels using S-AIS. Furthermore, the EOADP also plans to launch two new initiatives that will contribute to the development of a further 15 innovative EO applications and the increase of the level of expertise and competitiveness of Canadian industry.

Sub-Sub-Program 1.1.3.2: Communications Services Utilization

Description

This Sub-Sub-Program develops the utilization of space communications, including Navigation, Positioning and Timing (NPT) services available through Canadian and foreign satellites. This Sub-Sub-Program is necessary to broaden the applicability of currently available communications services (optimization) or to create new ones (innovation) for Government of Canada (GoC) organizations.

This Sub-Sub-Program engages the participation of the Canadian space industry and is formalized under contracts and partnership agreements with national, public/private and international organizations. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
344,148	344,148	344,148

Human Resources (FTEs)

2016–17	2017–18	2018–19
0.5	0.5	0.5

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Enhanced GoC organizations ability to use communications space assets.	1. Number of communications application development activities supported.	0

Planning Highlights

Spectrum management is the only current activity funded under this Sub-Sub-Program. Spectrum management is essential in securing the proper communication frequencies necessary to monitor and control CSA satellites, to make use of the instruments/payloads on-board CSA satellites and to transmit the valuable data from the satellites to the ground station. Also, it protects current and future CSA space missions from potential harmful interferences from other terrestrial or space systems.

Sub-Sub-Program 1.1.3.3: Scientific Data Utilization

Description

This Sub-Sub-Program develops the utilization and validates the quality of Canadian and foreign space-based scientific data and derived information that address science questions, such as those related to our understanding of the Earth's climate system and magnetic field (magnetosphere). This Sub-Sub-Program involves the collaboration of Canadian scientists from Government of Canada (GoC) organizations and academia. This Sub-Sub-Program is necessary to broaden the applicability of currently available space scientific data (optimization) or to create new ones (innovation) for GoC organizations and academia, especially in weather forecasts, climate change and space weather.

This Sub-Sub-Program engages the participation of the Canadian space industry, academia and GoC organizations scientists, and is formalized under contracts and partnership agreements with national, public/private and international organizations. This Sub-Sub- Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
1,338,752	918,752	918,752

Human Resources (FTEs)

2016–17	2017–18	2018–19
0.2	0.2	0.2

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Enhanced scientific community ability to use scientific data.	1. Number of Sun-Earth system scientific data activities supported.	15 (SMAP 6, GO 8 and MOPITT 1)

Planning Highlights

The focus of this program for the coming year is to sustain the capacity of the scientific community to use observations from space and to derive new knowledge from currently operating scientific instruments. These observations provide a better understanding of the Sun-Earth System (climate, space weather) and critical benchmarks for developing predictive models.

Long-term observations of essential climate variables are needed to quantify trends and to distinguish extreme events from natural variations. Societal resilience to Climate Change and Space Weather relies on predictive capability that is anchored in science and observations. Soil moisture and solar storms are two important components of this program.

The CSA will continue collaborating with Environment Canada (EC) and with Agriculture and Agri-Food Canada (AAFC) to support the Canadian Science and Applications Plan for NASA's Soil Moisture Active Passive (SMAP) mission. Canadian scientists from EC, AAFC and five Canadian universities, will participate in post-launch data calibration/validation and algorithms development activities as well as testing, demonstration, and implementation of SMAP data and algorithms for Canadian regional products and other related activities. SMAP data will improve the representation of energy, water and carbon cycles in Canadian environmental analysis and prediction systems using soil moisture and freeze/thaw data.

The CSA will continue supporting Canadian university scientists in generating new science knowledge from the study of the near-Earth space environment above Canada where space weather occurs. This research will use data acquired by the Geospace Observatory (GO) network of instruments located across Canada, and by Canadian instruments orbiting in space that make observations of the upper atmosphere, ionosphere, aurora borealis and magnetosphere. The scientific investigations carried out will help to deepen the understanding of the processes that generate space weather. There is a pressing need to tackle this challenge both from an economic and security perspective. Damage caused to satellites and ground infrastructure; interference with communication and navigation signals; and failure of electrical systems could all be mitigated with better prediction of space weather allowing appropriate measures to be taken to lessen the effect.

Program 1.2: Space Exploration

Description

This Program provides valuable Canadian science, signature technologies and qualified astronauts to international space exploration endeavors. This Program contributes to the Government of Canada's Science and Technology Strategy. It fosters the generation of knowledge as well as technological spinoffs that contribute to a higher quality of life for Canadians. It generates excitement within the population in general and contributes to nation-building. This Program appeals to the science and technology communities. It is targeted mostly towards Canadian academia and international space exploration partnerships. Canadian industry also benefits from the work generated within this Program.

This Program is delivered with the participation of foreign space agencies and Government of Canada (GoC) organizations. This collaborative effort is formalized under international partnership agreement, contracts, grants or contributions.

Budgetary Financial Resources (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
99,437,361	99,437,361	99,827,265	88,888,616

Refer to sub-sub-programs for details on significant planned spending variation.

Human Resources (FTEs)

2016–17	2017–18	2018–19
160.6	161.2	160.7

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Expansion of advanced scientific knowledge acquired through space exploration endeavours.	1. Number of peer-reviewed scientific publications, reports and conference proceedings using space exploration information and produced by researchers (sciences and technology) in Canada.	200

2. Multiple use and applications of knowledge and know-how acquired through space exploration endeavours.	1. Number of terrestrial applications of knowledge and know-how acquired through space exploration endeavours.	1
	2. Number of space re-utilizations of knowledge and know-how acquired through space exploration endeavours.	1

Planning Highlights

The CSA will consult with Canadian industry, academia and international partners to identify current and potential future space exploration missions ensuring that Canada's Space Exploration Program delivers on expected results. Through consultation, the CSA will identify opportunities that will generate world class science, innovation and technologies, with spin-offs for terrestrial applications.

The CSA will continue to provide technologies and services to the ISS Program as part of its commitment to share ISS Common System Operations Costs to 2024. Canadian universities and companies will continue to develop experiments and payloads to take advantage of the ISS as a research laboratory. Canada's focus will continue to be on health research as this is an area with high potential for terrestrial benefits.

The CSA will continue to fulfill its International Space Station (ISS) obligations by operating the Mobile Servicing System (MSS) until 2024. This involves providing operational and technical support for the MSS hardware and software; providing MSS training for astronauts and ground support personnel; and conducting operations, in conjunction with the NASA, from the Remote Multi-Purpose Support Room located in Longueil, Quebec.

As a terrestrial application, the knowledge acquired from Canadarm is being used for the development of Image Guided Automated Robot (IGAR): a robotic platform that will enable automated, image-guided, minimally invasive procedures for the treatment of various medical conditions.

As a space re-utilization in FY 2016–17, a Montreal-based company, GHGSat, will launch a commercial satellite to track greenhouse gases from space. This satellite will make use of an operations planning software developed under the CSA's exploration program.

Along with NASA and the European Space Agency, Canada is a lead partner in the James Webb Space Telescope (JWST) project, a major space observatory scheduled for launch in 2018. By virtue of CSA's contribution, Canadian astronomers will have guaranteed access to 5% of the observing time of the Space Telescope.

The CSA will maintain its human space flight expertise to meet the requirements of its Space Exploration program, with the next flight scheduled for the end of 2018. CSA's two Canadian astronauts are eligible for long-duration space flight assignments to the ISS. Canada's astronauts continue training, while assuming collateral duties in support to the ISS Program and CSA priorities.

Sub-Program 1.2.1: International Space Station (ISS)

Description

This Sub-Program uses the International Space Station (ISS)—a unique Earth-orbiting laboratory—to learn to live and work in space while conducting scientific, medical and engineering studies. It includes the assembly and maintenance of the ISS through the use of the Canadian Mobile Servicing System (MSS) and the design, development and operations of payloads and technological demonstrations aboard the ISS. This Sub-Program is necessary to generate specific understanding and technological advances to prepare for the challenges of space exploration and for terrestrial benefits. This Sub-Program provides Canadian industry and academia privileged access to the ISS.

This Sub-Program is performed in collaboration with Government of Canada (GoC) organizations and foreign space agencies. This collaborative effort is captured under contracts, contributions, grants and/or international partnership agreements.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
74,964,337	79,820,405	68,157,033

Refer to sub-sub-program 1.2.1.1 for details on significant planned spending variation.

Human Resources (FTEs)

2016–17	2017–18	2018–19
95.0	96.1	94.0

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Development of operational and technological know-how related to long-duration space missions (with potential Earth application) acquired through participation in the International Space Station (ISS) operations and laboratory missions.	1. Number of Canadian missions / solutions / instruments flown on ISS.	10
	2. Percentage of Canadian missions / solutions / instruments flown on ISS that met their mission requirements.	100%
2. Canada, a well-positioned partner, influences the ISS program direction.	1. Number of CSA's participation in ISS program boards and panels.	65

Planning Highlights

The CSA will continue to maintain MSS operational preparedness to carry out ISS maintenance and operations. This will entail the development and certification of new flight software products and operational procedures to support MSS operations. CSA will also continue to monitor the MSS health, perform engineering analysis, and put in place mitigation activities to maximize the MSS life.

Canadians will benefit from the ISS through CSA's development and implementation of state-of-the-art scientific research and innovative technology activities such as:

- Marrow, a health research study that will look at space effects on stem cells in the bone marrow and ramifications on spaceflight anemia with potential application to aging populations on Earth.
- Measurement of neutron radiation levels aboard the ISS using Canadian technology (Radi-N2 payload).
- An educational activity, Tomatosphere IV, aimed at stimulating the interest of students in biology and space science through exposure of tomato seeds to the space environment.

The CSA will continue to actively support the ISS Operational, Scientific and Medical Boards, Panels and Working Groups that are mandated by international agreements.

Sub-Sub-Program 1.2.1.1: International Space Station Assembly and Maintenance Operations

Description

This Sub-Sub-Program includes the provision and operation of the Canadian Mobile Servicing System (MSS), composed of three Canadian robots - Canadarm2, Dextre and the Mobile Base System. MSS operations and maintenance services are conducted by Canadian or foreign astronauts on board the International Space Station (ISS) and by ground controllers and engineers located in established facilities at the Canadian Space Agency (CSA) and the National Aeronautics and Space Administration (NASA) - Johnson Space Center. This Sub-Sub-Program also includes the provision of specialized MSS training, systems engineering and software services, flight procedures development as well as the facility infrastructure necessary t operate the MSS through its life cycle.

This Sub-Sub-Program is necessary to fulfill Canada's ongoing commitment to the international partnership to assemble and maintain the ISS, a legally binding obligation under the Canadian Civil International Space Station Agreement Implementation Act.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
64,913,481	62,947,449	55,771,370

Human Resources (FTEs)

2016–17	2017–18	2018–19
78.4	77.9	75.4

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. The Canadian contribution (Mobile Servicing System) meets the planned operational requirements identified in the ISS Increment Definition Requirements Document (IDRD) in accordance with the Intergovernmental Agreement (IGA) and the NASA/CSA Memorandum of Understanding (MOU).	1. Percentage of operational requirements fulfilled.	100%

Planning Highlights

The Canadian built Mobile Servicing System (MSS) will be used for the capture, maneuvering, mating, unloading and release of cargo vehicles to the ISS. Six (6) US commercial vehicles and one (1) Japanese vehicle are planned in FY 2016–17. The MSS will also be used for the installation and logistics management of equipment on the exterior of the ISS, and to support ISS operations including payload positioning, the handling of Astronauts on spacewalks, viewing operations, and deployment of scientific experiments.

To ensure the MSS meets operational requirements, the CSA will:

- Ensure certification of the MSS for all required on-orbit robotics operations;
- Deliver all necessary analyses and software products to assure, safe and efficient MSS operations;
- Maintain and provide the sustaining engineering for the MSS, including MSS spares;
- Support MSS operations with on-console operations and engineering resources;
- Train MSS operators and support staff on MSS operations; and
- Maintain and certify the Canadian ISS ground infrastructure.

The CSA will be directly involved in the ISS Program multi-lateral decision structure.

Sub-Sub-Program 1.2.1.2: International Space Station Utilization

Description

This Sub-Sub-Program encompasses the implementation of scientific, operational, medical and technological studies in specific areas, such as life sciences, radiation, material or fluid sciences, to be conducted aboard the International Space Station (ISS) by Government of Canada (GoC) organizations, academia or the private sector. The ISS offers said organizations the advantages of an orbiting platform with human presence and prolonged microgravity exposure. This Sub-Sub-Program is necessary for testing novel technologies and conducting scientific studies in the unique environment of the ISS, leading to a better understanding of long-duration space missions and to potential terrestrial benefits.

This Sub-Sub-Program is performed in collaboration with GoC organizations and foreign space agencies. This collaborative effort is captured under contracts and/or international partnership agreements. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
10,050,856	16,872,956	12,385,663

Human Resources (FTEs)

2016–17	2017–18	2018–19
16.6	18.2	18.6

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Optimal utilization of the International Space Station (ISS).	1. Percentage of programmatic objectives achieved through ISS utilization.	85%
	2. Number of Canadian stakeholders involved in activities on the ISS.	9
	3. Proportion of ISS resources used.	100%

Planning Highlights

Through this Sub-Sub-Program, the CSA pursues the following programmatic objectives:

- scientific use of the ISS by Canadian researchers;
- operational tests addressing, for example, current and future space medicine requirements;
- technology demonstrations, to test new Canadian technologies in a human-rated spacecraft;
- outreach activities, to communicate ISS achievements to Canadians; and
- learning activities, to make use of the unique opportunity of the ISS to enhance Canadian education programs and science awareness.

In 2016–17, the CSA expects to meet 85% of programmatic objectives through scientific studies on ISS (Marrow, Vascular Echo, At Home in Space, and T Bone), technology demonstrations (Microgravity Vibration Isolation System), operational activities (RadiN-2), and learning (Tomatosphere IV).

The CSA will support ISS utilization by nine university stakeholders, all addressing the health research focus. Stakeholders include the Universities of Waterloo, Western Ontario, and Tours

(France) (Vascular Echo), the University of Ottawa (Marrow), the University of British Columbia (At Home in Space), the University of Calgary and the German Sports University (T Bone), the University of Ontario Institute of Technology (RadiN2), and the University of Guelph (Tomatosphere IV).

Additionally, the CSA aims to optimize the use of its ISS resources, specifically ISS crew-time used to perform Canadian activities, and the transport and stowage of Canadian assets on the ISS. In past years, crew-time has been the most constraining resource for the CSA; therefore, reporting focuses on the proportion of crew-time allocated to the CSA that CSA actually uses. The CSA will make use of 100% of its allocation of ISS crew-time during 2016–17.

Sub-Program 1.2.2: Exploration Missions and Technology

Description

This Sub-Program encompasses the development and use of astronomy and planetary missions as well as the development of advanced exploration technologies. This Sub-Program is necessary as it contributes valued Canadian signature technologies to international space exploration endeavors and generates a better understanding of the universe, the solar system and our home planet. It could also lead to technology transfers for terrestrial benefits. This Sub-Program provides Canadian industry and academia with unique opportunities through their participation in international space exploration initiatives.

This Sub-Program is performed in collaboration with foreign space agencies, Government of Canada (GoC) organizations and through CSA participation in international groups, such as the International Space Exploration Coordination Group. This collaborative effort takes shape under contracts, grants, contributions and/or international partnership agreements.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
16,208,160	14,380,996	15,841,719

Human Resources (FTEs)

2016–17	2017–18	2018–19
51.6	53.3	54.9

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Technological know-how acquired through Space Exploration endeavors. (Astronomy and planetary).	1. Proportion the CSA's missions / solutions / instruments that met their mission performance requirements at acceptance review and/or at commissioning.	0
2. Canada maintains a strategic positioning which supports its capacity to influence space exploration missions and decision making process in key international space exploration forums.	1. Number of CSA's sponsored Highly Qualified Personnel (HQP) nominated on International Space Exploration decision bodies.	10
3. CSA's participation in space exploration missions provides access to scientific data about the Solar system and the Universe.	1. Number of CSA's sponsored space astronomy and planetary missions providing data to Canadian scientific community.	3

Planning Highlights

Canada will maintain its strategic positioning to influence space exploration missions, and the decision-making process in key international space exploration forums. For that purpose, HQP designated by CSA will represent Canada on various decision-making bodies such as the International Space Exploration International Space Exploration Coordination Group (ISECG), and also on international science teams for space missions in which CSA is participating (e.g. JWST Science Working Group; APXS Science Team).

Canada has been responsible for the design and construction of two critical elements of the James Webb Space Telescope (JWST): the Fine Guidance Sensor (FGS) and the Near Infrared Imager and Slitless Spectrograph (NIRISS). The FGS ensures very precise pointing of the telescope. The NIRISS is a science instrument. In 2016–17, CSA will continue to support NASA's integration and test activities in preparation for the launch in 2018. Through Canada's contribution, Canadian astronomers will have guaranteed access to 5% of the observing time of the telescope.

The CSA's participation in Japan's ASTRO-H mission, scheduled for launch in early 2016, will foster Canadian industrial capabilities in optics, and will enable Canadian scientists to submit proposals in FY 2016–17 for observations on the telescope.

The CSA will support operations of the Near Earth Object Surveillance Satellite (NEOSSat) that was launched in February 2013. NEOSSat is a microsatellite jointly sponsored by CSA and

Defence Research and Development Canada (DRDC), to discover near-Earth asteroids and to acquire orbital position and time data on man-made objects.

The CSA will deliver the OSIRIS-REx Laser Altimeter (OLA) instrument for the NASA OSIRIS-REx mission that will launch in late 2016. OSIRIS-REx will obtain samples from a distant asteroid and return them to Earth and as a result of Canada's contribution to this mission, Canada will own a portion of the returned sample, which will be studied by Canadian scientists.

The CSA will support the continued operations of Canada's contribution to NASA's Mars Science Laboratory (MSL), the Alpha Particle X-ray Spectrometer (APXS), a science instrument on the MSL Curiosity Rover that measures elemental composition of rocks and soils. Curiosity landed on Mars in 2012. The APXS instrument which has been operating for over 3 years and is expected to function beyond 2017 has showcased Canadian science and technology and has made important contributions to exploring the surface of Mars.

Sub-Sub-Program 1.2.2.1: Space Astronomy Missions

Description

This Sub-Sub-Program encompasses the definition, design, technology development, implementation and use of Canadian scientific instruments and signature technologies made available to Canadian and international space astronomy missions. This Sub-Sub-Program is necessary to perform space astronomy investigations and generate data and new knowledge about the universe.

This Sub-Sub-Program is performed in collaboration with foreign space agencies, Government of Canada (GoC) organizations and through consultations with the Canadian astronomical community. This collaborative effort takes shape under contracts and/or international partnership agreements. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
4,011,128	3,738,872	3,347,888

Human Resources (FTEs)

2016–17	2017–18	2018–19
4.4	4.0	3.0

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Canadian know-how and expertise allow Canada to lead or participate in international space astronomy missions.	1. Number of technological and scientific solutions being developed by the CSA in the context of astronomy missions.	1

Planning Highlights

The CSA will continue to support the commissioning of missions, including: the recently launched Astrosat, India's first space astronomy mission for which Canada has three imaging detectors to observe cosmic objects in the ultraviolet waveband; the Japanese ASTRO-H X-ray mission for which Canada provided a laser measurement system that will enhance the quality of images. The CSA will continue to prepare for the launch and operations of NASA's flagship space observatory JWST. Canada's NEOSSat mission which was launched in 2013 to monitor near-Earth objects in space is expected to begin science operations for near-Earth asteroids search. In evaluating options for future potential missions, CSA conducts preparatory studies, such as mission or instrument concept studies with industry and academia, reflecting Canada's scientific priorities, with international opportunities.

Sub-Sub-Program 1.2.2.2: Planetary Missions

Description

This Sub-Sub-Program encompasses the definition, design, technology development, implementation and use of Canadian scientific instruments and signature technologies made available to international exploration missions. The Sub-Sub-Program is necessary to reach exploration destinations such as planets and asteroids or new exploration platforms to conduct planetary science investigations, to generate data and new knowledge and to conduct engineering and/or planetary resource management activities.

This Sub-Sub-Program is performed in collaboration with the international space exploration community, Government of Canada (GoC) organizations and foreign space agencies. This collaborative effort takes shape under contracts and/or international partnership agreements. This

Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
3,959,356	2,251,892	3,860,880

Human Resources (FTEs)

2016–17	2017–18	2018–19
6.1	5.3	5.6

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Canadian know-how and expertise allow Canada to participate in planetary exploration missions.	1. Number of technological and scientific solutions being developed by the CSA in the context of planetary exploration missions.	1

Planning Highlights

The CSA will deliver the OSIRIS-REx Laser Altimeter (OLA) instrument for the NASA OSIRIS-REx mission that will launch in late 2016. The OSIRIS-REx mission will map the surface of a distant asteroid and bring samples back to Earth for analysis. Canada's contribution, the OLA instrument is an advanced laser scanning Light Detection and Ranging (LIDAR) that will provide global topographic mapping of the asteroid's surface.

Sub-Sub-Program 1.2.2.3: Advanced Exploration Technology Development

Description

This Sub-Sub-Program includes the development of advanced Canadian signature technologies to be used in potential astronomy and planetary missions that could be destined for the Moon, Mars, asteroids or other celestial bodies. This Sub-Sub-Program is necessary to shape or determine the nature of Canada's contribution to potential international exploration and astronomy missions and could lead to spin-offs. In addition, the Sub-Sub-Program includes terrestrial deployments in analogue sites that offer geological similarities with Martian or Lunar surfaces, where this technology and its operational aspects are being tested and where exploration-related science is conducted for proof of concepts.

This Sub-Sub-Program is performed in collaboration with foreign space agencies and Government of Canada (GoC) organizations and through the Canadian Space Agency participation in international groups, such as the International Space Exploration Coordination Group. This collaborative effort takes shape under contracts and/or international partnership agreements.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
8,237,676	8,390,232	8,632,951

Human Resources (FTEs)

2016–17	2017–18	2018–19
41.1	44.0	46.3

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Maturing science, technology and operational solutions for planning and strategic positioning purposes.	1. Number of science, technology and operational solutions that are under development in conformity with the orientations and conclusions of the Canadian Space Exploration plan.	3

Planning Highlights

As a result of the centralization of technology development activities under Science and Technology Development Program (STDP), sub-sub program 1.2.2.3 now includes the investigation of concepts for space exploration missions, but not the technology development.

The CSA will continue to define the nature of Canada's contribution to future international exploration and astronomy missions. This sub-sub-program will contribute to this strategic area of action and will develop plans and roadmaps for Canadian contributions to space exploration, thus positioning Canada for future missions. In collaboration with our international partners, CSA will continue to define concepts and assess feasibility for missions Beyond Low Earth Orbit (BLEO) in the areas of Advanced Crew Medical System (ACMS), Beyond LEO Relative Navigation System, and Deep-Space Exploration Robotics (DSXR).

Sub-Program 1.2.3: Human Space Missions and Support

Description

This Sub-Program encompasses all activities required to recruit, develop, train and maintain a healthy and highly qualified Canadian astronaut corps capable of participating in space exploration missions. It also includes all activities directed at mitigating health risks associated with those missions, such as the development of advanced technologies to be used in support of human space missions. This Sub-Program is necessary to generate specialized knowledge in fields that sustain human space flights, such as life sciences and space medicine. Furthermore, by exploring technological solutions to the various challenges of human space flight, this Sub-Program could contribute to alternate health care delivery mechanisms for terrestrial applications.

This Sub-Program is performed with Government of Canada (GoC) organizations and foreign space agencies. This collaborative effort is formalized under contracts, grants, contributions or international partnership agreements.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
8,264,864	5,625,864	4,889,864

Human Resources (FTEs)

2016–17	2017–18	2018–19
14.0	11.8	11.8

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Human space flight generates "unique" health and life science knowledge, and technological know-how to sustain life and mitigate health risk during long-duration space flight.	1. Number of activities that lead to health risk mitigation strategies, technologies and/or countermeasures.	11

Planning Highlights

In order to maintain astronaut health and performance, it is necessary to identify and characterize spaceflight risks. In collaboration with international partners and other government departments the CSA is looking to take advantage of the special one year crew mission on the ISS (typical crew missions last 6 months) that took place in 2015–16, to undertake in 2016–17 a radiation health and monitoring activity studying chromosomes in astronauts after their exposure to space radiation.

The Health Research Program managed by CSA will continue to develop and support activities related to the identification, characterization and mitigation of risks to humans in space. This research may also lead to benefits on Earth. For this reason, the Health Research Program is developing partnerships with both the National Research Council of Canada and the Canadian Institutes of Health Research.

Preparatory activities are also being undertaken to validate hypotheses for potential future testing on the International Space Station (ISS). Several studies are being initiated through CSA's participation in the European Life and Physical Sciences program of the European Space Agency. These studies require isolation or proximal inactivity which are provided by European facilities, and involve Canadian collaboration with European scientists.

The CSA will continue to work with the ESA, JAXA, NASA, the German Space Agency (DLR), the French Space Agency (CNES) and the Italian Space Agency (ASI) to support Canadian science experiments through coordinating space life sciences and multinational world-class scientific research.

Sub-Sub-Program 1.2.3.1: Astronaut Training and Missions

Description

This Sub-Sub-Program encompasses activities associated with all phases of an astronaut's career from recruitment to retirement, including space missions. This Sub-Sub-Program includes the management of National Astronaut Recruitment Campaigns; the implementation of individualized astronaut career management plan; the implementation of basic, advanced and mission-specific training; collateral duties assignment; space mission negotiations and assignment; as well as all the logistical, administrative and operational support activities in the pre-flight, in-flight and post-flight periods. This Sub-Sub-Program is necessary to live and work in a space environment and in order to further our understanding of human behaviour and health in space, and to conduct experiments and collect space-based scientific data useful to the science community.

This Sub-Sub-Program is performed with Government of Canada (GoC) organizations and foreign space agencies. This collaborative effort is formalized under contracts or international partnership agreements.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
5,458,160	3,308,160	2,580,160

Human Resources (FTEs)

2016–17	2017–18	2018–19
7.0	7.0	7.0

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Canadian astronaut corps is ready to assume any responsibilities on an expedition to the International Space Station (ISS).	1. Number of astronaut activities undertaken in preparation for eventual ISS mission assignments.	3

Planning Highlights

In order to capitalize on Canada's space flight opportunities, CSA must maintain a healthy, versatile and well trained corps of astronauts, ready to assume any role or responsibility assigned to them during a spaceflight mission. In order to ensure this, CSA will continue to provide

comprehensive training opportunities to its corps of astronauts, and assign them strategic collateral duties, that will give them the necessary knowledge, skills and attitudes to excel during mission training and ultimately during space missions.

Canada's next long-duration space mission is planned to launch to the ISS, aboard a Russian Soyuz vehicle, in November 2018. One Canadian astronaut is expected to be assigned to that mission in the spring of 2016. Mission-specific training consists of 26 months of training on the launch vehicle, payloads and space station systems, at the various international partner training sites. Pre-assignment training activities include ISS Systems training, robotics training, Extra Vehicular Activities (EVA) training, flight training, Russian language training, medical training, as well as expedition-type training such as field geology and caving.

Collateral duties are an important part of the astronauts' day-to-day activities – they are jobs and tasks assigned to astronauts posted at NASA/Johnson Space Center in Houston, Texas; they allow the astronauts to gain invaluable technical, managerial and leadership skills, which in turn prepare them for better success during space missions and later as their careers progress beyond the astronaut corps. Collateral duties for Canadian astronauts include Lead Capsule Communicator (Capcom) roles for upcoming ISS cargo visiting vehicles, which use Canada's Mobile Servicing System to grapple and berth them to the space station

Sub-Sub-Program 1.2.3.2: Operational Space Medicine

Description

This Sub-Sub-Program delivers operational and clinical health care activities during all phases of basic, advanced and mission-specific training as well as during the pre-flight, in-flight and post-flight periods. It also promotes and ensures the physical, mental, social well-being and safety of Canadian astronauts. This Sub-Sub-Program is necessary to ascertain the overall health of Canadian astronauts and to monitor long-term health status.

This Sub-Sub-Program is performed with Government of Canada (GoC) organizations and foreign space agencies. This collaborative effort is formalized under contracts or international partnership agreements. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
1,255,904	1,255,904	1,255,904

Human Resources (FTEs)

2016–17	2017–18	2018–19
3.5	3.5	3.5

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Astronauts' health is optimized to meet mission requirements.	1. Number of active astronauts medically certified for ISS assignment and duties.	2/2
2. Astronauts' long-term health is monitored following their active careers.	1. Percentage of eligible astronauts participating in their long-term health monitoring.	80%

Planning Highlights

The CSA will continue to provide medical support for CSA's active astronauts (clinical medicine, human behaviour and performance, countermeasures and nutrition).

The CSA will plan the medical support and begin executing pre-flight medical support necessary to meet the medical requirements established by the International Space Station (ISS) Medical Program for the long-duration space mission scheduled to launch in November 2018.

The CSA will continue seeking collaborative efforts with national and international partners for the purpose of optimizing the health of astronauts through the delivery of healthcare and implementation of mitigation strategies.

In order to confirm that the health of astronauts is optimized to meet mission requirements, medical certification of astronauts for ISS duties by the Multilateral Space Medicine Board (MSMB) must take place annually against a multilaterally agreed common set of medical standards. CSA's two astronauts will be presented at the MSMB for their annual re-certification for ISS duties.

Astronauts' long-term health is monitored following their active careers through their participation in the NASA Lifetime Surveillance of Astronaut Health (LSAH). Although a

voluntary program, CSA strongly encourages the participation in LSAH, of all Canadian astronauts who have retired from the program.

Sub-Sub-Program 1.2.3.3: Health and Life Sciences

Description

This Sub-Sub-Program encompasses space medicine and life science activities that explore health care delivery and life sustainability solutions on future long-duration exploration missions. These benefits are targeted at the space exploration community, mainly academia and partnering agencies. This Sub-Sub-Program develops collaborative projects with academia and industry. It uses analogue sites that offer relevant similarities with the harsh environment of space, and where exploration-related medical and life science studies are conducted. This Sub-Sub-Program is necessary to identify, understand, mitigate or eliminate health risks associated with human space flights, and to understand and address the needs of humans during those missions. The solutions could also be offered as alternative health care delivery mechanisms for terrestrial benefits through the transfer of space technology.

This Sub-Sub-Program is performed with Government of Canada (GoC) organizations and foreign space agencies. This collaborative effort is formalized under contracts or international partnership agreements. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
1,550,800	1,061,800	1,053,800

Human Resources (FTEs)

2016–17	2017–18	2018–19
3.5	1.3	1.3

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Performance of space life sciences studies with potential benefits for Canadians and to enable human exploration of space.	1. Number of activities aimed at the understanding and mitigation of risks to human associated with spaceflight.	8
	2. Number of partnerships addressing potential terrestrial health care solutions.	2

Planning Highlights

Four research activities are planned for FY 2016–17 in support of human research. Three will use a human analogue model of inactivity that simulates many physiological changes that occur in space. The fourth study uses the isolation of an Antarctic station as an analogue of the isolation in space for a psycho-social study of adaptation to extreme isolation.

The Life Sciences Research Systems activity is planning to develop specific technologies in support of health research in space. The two types of technology targeted are bioanalysis and biomonitoring. In meeting the constraints of space, these technologies may have spin off potential for health research and health care delivery in remote areas, the home, military outposts and other locations.

Long durations in space induce health changes similar to those of aging, such as cardiovascular and balance changes, weakening of bones and muscles, disturbed sleep, sensory system changes and depressed immune response. In addition, astronauts must contend with isolation, monotony and separation from family which are also challenges confronted by the elderly. Unlike aging, however, many of the space health risks are reversible. The Space Health and Aging Research SHARE initiative brings together the Canadian Space Agency and the Canadian Institutes of Health Research to collaborate in the study of common concerns.

CSA is partnering with the National Research Council to develop a specific technology that will prepare biological samples for analysis. Current protocols require many steps, are often labour intensive and require elaborate equipment. The creation of a technological solution that is small, simple and effective be invaluable both in space and on Earth.

Program 1.3: Future Canadian Space Capacity

Description

This Program attracts, sustains and enhances the nation's critical mass of Canadian space specialists, fosters Canadian space innovation and know-how, and preserves the nation's space-related facilities capability. In doing so, it encourages private-public collaboration that requires a concerted approach to future space missions. This Program secures the nation's strategic and ongoing presence in space in the future and to preserve Canada's capability to deliver internationally renowned space assets for future generations. It is targeted at Canadian academia, industry and youth, as well as users of Canadian space solutions (Government of Canada [GoC] organizations) and international partners.

This Program is conducted with the participation of funding agencies, GoC organizations along with government facilities and infrastructure, foreign space agencies, not-for-profit organizations and provincial governments. This collaborative effort is formalized under contracts, grants, contributions or national and international partnership agreements.

Budgetary Financial Resources (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
66,094,200	66,094,200	65,800,960	67,060,502

Human Resources (FTEs)

2016–17	2017–18	2018–19
91.6	92.5	93.5

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Canada holds a space community (academia, industry and government) able to contribute to the sustained and strategic Canadian use of space.	1. Number of FTE/HQP in the Canadian space sector.	8000 FTE
	2. Monetary value of the Canadian space sector R&D investments.	$160 million

Planning Highlights

In consultation with partners and stakeholders in the government, industry and academia, the CSA will continue to foster a strong Canadian space sector to support an innovative and knowledge-based economy. The CSA will continue to support the development of the workforce-of-tomorrow in space science and technology domains by working with universities, industry and partners. The CSA will continue its support for technology development while reviewing delivery mechanisms to maximize the innovation impact.

To encourage innovation, the CSA will offer demonstration opportunities for industry and academia to test new capabilities in science and technology in realistic environments using rovers, balloons, aircraft and sounding rockets and potentially space flights.

The CSA will also pursue discussions with the Canadian space sector to optimize the support provided by the David Florida Laboratory to ensure complementarity of assembly, testing and integration facilities for the Canadian space industry or universities.

Sub-Program 1.3.1: Space Expertise and Proficiency

Description

This Sub-Program includes the development and enhancement of Canada's space capacity. This Sub-Program supports research in private or public organizations and sustains the development of highly qualified personnel in science and engineering. We encourage scientists and engineers to perform relevant development activities in space science and technology, and to develop their know-how by offering them financial support to sustain their research project and access to infrastructure devoted to world-class research and training, among which fast execution and small-size missions offer frequent flight opportunities. This Sub-Program is necessary to create and sustain a pool of space expertise and proficiency that will form the next generation of space professionals and workers and to provide solutions for future Canadian space endeavours.

This Sub-Program is delivered with the participation of funding agencies, Government of Canada (GoC) organizations, foreign space agencies and not-for-profit organizations. This collaborative effort is formalized under national and international partnership or contracts. This Sub-Program is also funded through the Class Grant and Contribution Program to Support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
10,475,124	10,634,024	11,887,879

Human Resources (FTEs)

2016–17	2017–18	2018–19
38.6	39.4	40.4

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. A pool of space experts and professionals is sustained and enhanced.	1. Number of scientists and engineers involved through opportunities provided by the program.	300
2. Research is conducted in priority areas.	1. Number of research projects conducted through opportunities provided by the program.	30
3. Advancement of Science and Technology solutions for future space initiative.	1. Number of peer-reviewed papers, reports and conference proceedings acknowledging CSA support.	350

Planning Highlights

The CSA will continue to manage the development of initiatives aimed at attracting science, technology, engineering, mathematics, and business talents into the space sector, preparing students to enter the space sector workforce, and stimulating academia to take an increased part in the space economy. This will include the management of existing agreements with key space sector players, as well as new agreements.

The CSA will overhaul its strategic approach to supporting academia, science and workforce development and consult with interested parties. Optimizing programs and leveraging funding through partnerships with other government and non-government organizations will be a key principle.

The CSA will continue delivering pre-space capability demonstration activities through: rover deployment to emulate planetary exploration; parabolic flights to replicate micro-gravity conditions and; stratospheric balloons to emulate space radiation, temperature, and atmospheric

pressure. The CSA will also explore how to provide frequent space flight demonstration opportunities.

CSA will continue providing engineering and technical expertise in support of its space activity partnerships with academia, industry and government organizations.

Sub-Program 1.3.2: Space Innovation and Market Access

Description

This Sub-Program includes the development and enhancement of Canada's space capacity through innovation and market positioning. Through leading-edge technology and facilities, and international arrangements, the Sub-Program improves Canadian industrial competitiveness so that space users are continuously well served through constantly improving optimal and cost-effective space solutions. This Sub-Program is necessary to foster entrepreneurship that enhances Canadian industry's international positioning on commercial and government markets.

This Sub-Program is performed with industry and is formalized under contracts or contributions. Foreign space agencies are partners in this endeavour, so that Canadian industry can access foreign markets through innovation or international arrangements.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
50,000,768	49,548,628	49,554,316

Human Resources (FTEs)

2016–17	2017–18	2018–19
19.2	19.3	19.3

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Through innovation and international arrangements, Canadian industry is well positioned on international commercial and government markets.	1. Number of Canadian companies exporting space-related goods and services.	50
	2. Value of Canadian space-related goods and services exported.	$1.6 Billion

2. Enhanced Canadian industry competitiveness.	1. Number of Canadian companies successfully obtaining national /international work orders.	100

Planning Highlights

The CSA will continue to manage the development of space technology initiatives aimed at supporting future missions that respond to government needs as well as supporting Canadian industry competitiveness.

To support business innovation and economic development in the space sector, CSA will complete the planning steps started last year to further enhance Canadian industry's international positioning in commercial and government markets.

Sub-Sub-Program 1.3.2.1: International Market Access

Description

This Sub-Sub-Program consists in facilitating foreign market access by the Canadian space industry through negotiating, implementing and managing special international arrangements. For example, in return for Canadian Space Agency (CSA) monetary contributions to the European Space Agency (ESA) under the long-lasting ESA-Canada Agreement, Canadian industry obtains some of the contracts awarded by ESA; thus penetrating a market that would otherwise be limited to Europeans. This Sub-Sub-Program is necessary as it results in increased access to foreign government market share for Canadian industry.

This Sub-Sub-Program is delivered through concluding international agreements, trade measures, or other mutually beneficial arrangements that create a favorable political or trade environment that facilitates access to global markets. This Sub-Sub Program is funded through the European Space Agency Contributions program.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
27,500,580	27,043,580	27,044,580

Human Resources (FTEs)

2016–17	2017–18	2018–19
2.2	2.2	2.2

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Canadian investments through the European Space Agency (ESA) Agreement allow Canadian industry to access the institutional European market.	1. Canadian industrial return coefficient (Ratio between the actual value of contracts awarded by ESA to Canadian organizations and the ideal value of contracts awarded by ESA to Canadian organizations).	91%
2. The Canadian industry has access to flight opportunities for its space technologies and components.	1. Number of technologies or components developed by Canadian industry which have been space qualified and/or have acquired flight heritage-through Canada's participation in ESA Programs.	5

Planning Highlights

The CSA will continue to manage its investment in the European Space Agency (ESA) in support of access to European markets to ensure that the Canadian industrial return coefficient remains high.

For the duration of the ESA-Canada Agreement (2012–19) the CSA has established a target of 5 technologies to be space qualified or have acquired flight heritage. With 4 technologies to date and 1 technology in preparation, the target will be reached before the end of the agreement.

The CSA will invest an additional $30 million in the ESA satellite communications technology development program, and will consult with the industrial space sector to establish strategies. Canada's commitment to new investments will be communicated to the ESA Council at Ministerial level, planned for the end of 2016.

Sub-Sub-Program 1.3.2.2: Enabling Technology Development

Description

This Sub-Sub-Program consists of technology development and demonstration activities that contribute to maintaining or developing a technological edge in promising fields, such as switches, batteries, launchers, antennas, solar panels, etc. This Sub-Sub-Program is necessary as the enabling (generic) technology developed reduces costs and technological risks on multiple mission types, enhances the efficiency or performance of already established space solutions, and facilitates the commercialization of new products through innovation.

This Sub-Sub-Program is performed with industry and is formalized under contracts. This Sub-Sub-Program is also funded through the Class Grant and Contribution Program to support Research, Awareness and Learning.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
22,500,188	22,505,048	22,509,736

Human Resources (FTEs)

2016–17	2017–18	2018–19
17.0	17.1	17.1

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Increased technological capability of Canadian industry.	1. Number of different technologies addressed.	65

Planning Highlights

The CSA will continue to manage the development of space technology initiatives aimed at supporting future missions that respond to government needs as well as supporting Canadian industry competitiveness. This will include the management of existing contracts and contribution agreements, as well as new ones. A total of 55 contribution agreements and 24 contracts addressing 65 technologies will be managed in FY 2016–17.

Through consultation with stakeholders and partners, the CSA will renew its strategic approach for space technology development and prepare new funding opportunities accordingly.

Sub-Program 1.3.3: Qualifying and Testing Services

Description

This Sub-Program consists of specialized activities and services for the assembly, integration, and testing of space hardware and involves space qualifying technology, sub-units, units or entire spacecraft developed by Canadian academic institutions, Government of Canada (GoC) organizations, and industry, as well as international partners and clients. This Sub-Program is necessary to ensure that mission-assigned technology and entire systems can safely and reliably meet the rigours of space and to demonstrate the suitability and effectiveness of new Canadian space technology for providing valuable contributions to space missions. This provides an effective base for increasing Canada's capability to participate in future space programs.

This Sub-Program is delivered by the CSA's David Florida Laboratory on a fee-for-service basis.

Budgetary Financial Resources (dollars)

2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
5,618,308	5,618,308	5,618,307

Human Resources (FTEs)

2016–17	2017–18	2018–19
33.8	33.8	33.8

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Test results of space hardware prove to be reliable in demonstrating suitability for launch and space environment.	1. Percentage of client satisfaction towards the quality of the services provided.	95%

Planning Highlights

The David Florida Laboratory (DFL) will continue to provide cost-effective environmental space qualification services, on a fee for service basis, for the assembly, integration and testing (AIT) of spacecraft systems for CSA's programs, as well as other national and international clients. The CSA continues to make its test, research and qualification facilities accessible and available to academia and the Canadian space industry. The DFL Infrastructure Accelerated Refit project is being performed to ensure that the DFL is maintained as a state-of-the-art facility and that a high level of client satisfaction is sustained.

With respect to CSA programs, testing the RADARSAT Constellation Mission (RCM) components, subsystems, SAR antenna panels, and spacecraft (Per-flight model and Flight model-1) will dominate DFL activities over the course of FY 2016–17.

In addition, various antennas, components, payloads and cube-satellites or industry and government clients will be assembled, integrated and tested.

In FY 2016–17 DFL will continue the initiative, begun in 2014, to revise its business model, to find new markets for its services, and opportunities for industry to develop new revenue sources.

Program 1.4: Internal Services

Description

Internal Services are groups of related activities and resources that are administered to support the needs of programs and other corporate obligations of an organization. Internal services include only those activities and resources that apply across an organization, and not those provided to a specific program. The groups of activities are Management and Oversight Services; Communications Services; Legal Services; Human Resources Management Services; Financial Management Services; Information Management Services; Information Technology Services; Real Property Services; Materiel Services; and Acquisition Services.

Budgetary Financial Resources (dollars)

2016–17 Main Estimates	2016–17 Planned Spending	2017–18 Planned Spending	2018–19 Planned Spending
51,777,088	51,777,088	50,549,280	46,017,950

Human Resources (FTEs)

2016–17	2017–18	2018–19
263.7	264.2	264.5

Performance Measurement

Expected Results	Performance Indicators	Targets to be achieved by March 31, 2017
1. Demonstration of Canadian Space Agency's good management.	1. CSA's result against the Management Accountability Framework (MAF) criteria according to assessment of last round.	Acceptable conformity and departmental comparison

Planning Highlights

The CSA will continue to support the Ministers' of Innovation, Science and Economic Development with the implementing and continuous improvements of its organizational structure that is responsive to the strategic objectives of Canada's Space Policy Framework and to the priorities of the Government.

The CSA will continue to provide Secretariat support to the Space Advisory Board to ensure the effective operation of the Board.

The CSA will continue its work on a CSA Strategy that identifies a clear role for the CSA within the Canadian Space Program and a common vision with which to focus and drive sound

investment decision-making, all based on the current and future context defined by Federal Government strategies, plans and Space sector reports.

The CSA will continue to work with space industry leaders to identify ways in which the private sector can play a stronger leadership role to ensure that the economic value of the government's space investments are fully realized.

The CSA continues to actively support activities and programs aligned with the "Inspiring Canadians" principle of motivating young Canadians to pursue careers in science, technology, engineering and math (STEM), as outlined in the Framework.

The CSA will continue integrating renewal initiatives for the Public Service in strategic and operational plans to create a streamlined and efficient organization that shapes our future and allows meeting the challenges ahead.

The CSA will continue to implement its people-effective management strategy, an integrated three-year strategy that focuses on improving working conditions, ensuring healthy and empowering work environments, establishing a productive and skilled workforce and the delivery of internal services that are modern, efficient and relevant to clients.

Over the next two years, the CSA will continue performing accelerated infrastructure upgrades and repairs at the David Florida Laboratory to maintain its capacities as a state-of-the-art facility for assembly, integration and testing (AIT) of spacecraft and space components, and to ensure compliance with applicable building codes and standards.

The CSA will continue with the implementation of its three-year information management and information technology strategy including the governmental transformation initiatives and projects. This strategy aims to manage effectively and efficiently all information resources of business value, and the organization's IT applications according to their criticality and their life cycle in order to support the CSA's mandate.

The CSA will continue to develop and implement a departmental security framework to mitigate corporate security key risks, implement mandatory training, and will continue to raise staff awareness on the importance of safety issues.

The CSA will continue the implementation of a five-year Evaluation Plan as well as Performance Measurement Strategies.

The CSA will continue the monitoring of management action plans developed in response to audits and evaluations as well as third party recommendations.

Section III: Supplementary Information

Future-Oriented Condensed Statement of Operations

The future-oriented condensed statement of operations provides a general overview of the Canadian Space Agency's operations. The forecast of financial information on expenses and revenues is prepared on an accrual accounting basis to strengthen accountability and to improve transparency and financial management.

Because the future-oriented condensed statement of operations is prepared on an accrual accounting basis, and the forecast and planned spending amounts presented in other sections of the Report on Plans and Priorities are prepared on an expenditure basis, amounts may differ.

A more detailed future-oriented statement of operations and associated notes, including a reconciliation of the net cost of operations to the requested authorities, are available on the Canadian Space Agency's website[ix].

Future-Oriented Condensed Statement of Operations
For the Year Ended March 31, 2016
(dollars)

Financial information	2015–16 Estimated Results	2016–17 Planned Results	Difference (2016–17 Planned Results minus 2015–16 Forecast Results)
Total expenses	356,415,477	370,551,421	14,135,944
Total revenues	0	0	0
Net cost of operations before government funding and transfers	356,415,477	370,551,421	14,135,944

Expenses

Total expenses, estimated on an accrual accounting basis, are projected to be $370,551,421 in 2016–17 and are substantially the same level as estimated in 2015–16 ($356,415,477), an increase of $14,135,944 (4%). A significant portion of these expenses is broken down as follow: $118,002,118 in professional and special services, $71,911,927 in amortization and $69,891,840 in salaries and fringe benefits. These expenses include planned spending presented in this Report on Plans and Priorities as well as expenses such as amortization, services provided without charge by other government departments, and severance benefits and vacation pay liability adjustments.

Revenues

Total revenues are projected to be $2,064,746 in 2016–17 which are mostly constituted of sales of goods and services. The Agency's respendable revenues will be nil since the Agency has no authority regarding their disposition.

Supplementary Information Tables

The supplementary information tables listed in the 2016–17 Report on Plans and Priorities are available on the CSA's website.

- Details on Transfer Payment Programs of $5 Million or More;
- Status Report on Transformational and Major Crown Projects;
- Upcoming Internal Audits and Evaluations over the next three fiscal years; and
- Departmental Sustainable Development Strategy.

Tax Expenditures and Evaluations

The tax system can be used to achieve public policy objectives through the application of special measures such as low tax rates, exemptions, deductions, deferrals and credits. The Department of Finance publishes cost estimates and projections for these measures annually in the *Tax Expenditures and Evaluations*[x] publication. The tax measures presented in that publication are the responsibility of the Minister of Finance.

Section IV: Organizational Contact Information

Canadian Space Agency

Communications and Public Affairs
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Appendix: Definitions

Appropriation: Any authority of Parliament to pay money out of the Consolidated Revenue Fund.

budgetary expenditures: Operating and capital expenditures; transfer payments to other levels of government, organizations or individuals; and payments to Crown corporations.

Departmental Performance Report: Reports on an appropriated organization's actual accomplishments against the plans, priorities and expected results set out in the corresponding Reports on Plans and Priorities. These reports are tabled in Parliament in the fall.

full-time equivalent: A measure of the extent to which an employee represents a full person-year charge against a departmental budget. Full-time equivalents are calculated as a ratio of assigned hours of work to scheduled hours of work. Scheduled hours of work are set out in collective agreements.

Government of Canada outcomes: A set of 16 high-level objectives defined for the government as a whole, grouped in four spending areas: economic affairs, social affairs, international affairs and government affairs.

Management, Resources and Results Structure: A comprehensive framework that consists of an organization's inventory of programs, resources, results, performance indicators and governance information. Programs and results are depicted in their hierarchical relationship to each other and to the Strategic Outcome(s) to which they contribute. The Management, Resources and Results Structure is developed from the Program Alignment Architecture.

non-budgetary expenditures: Net outlays and receipts related to loans, investments and advances, which change the composition of the financial assets of the Government of Canada.

performance: What an organization did with its resources to achieve its results, how well those results compare to what the organization intended to achieve, and how well lessons learned have been identified.

performance indicator: A qualitative or quantitative means of measuring an output or outcome, with the intention of gauging the performance of an organization, program, policy or initiative respecting expected results.

performance reporting: The process of communicating evidence-based performance information. Performance reporting supports decision making, accountability and transparency.

planned spending: For Reports on Plans and Priorities (RPPs) and Departmental Performance Reports (DPRs), planned spending refers to those amounts that receive Treasury Board approval by February 1. Therefore, planned spending may include amounts incremental to planned expenditures presented in the Main Estimates.

A department is expected to be aware of the authorities that it has sought and received. The determination of planned spending is a departmental responsibility, and departments must be able to defend the expenditure and accrual numbers presented in their RPPs and DPRs.

plans: The articulation of strategic choices, which provides information on how an organization intends to achieve its priorities and associated results. Generally a plan will explain the logic behind the strategies chosen and tend to focus on actions that lead up to the expected result.

priorities: Plans or projects that an organization has chosen to focus and report on during the planning period. Priorities represent the things that are most important or what must be done first to support the achievement of the desired Strategic Outcome(s).

program: A group of related resource inputs and activities that are managed to meet specific needs and to achieve intended results and that are treated as a budgetary unit.

Program Alignment Architecture: A structured inventory of an organization's programs depicting the hierarchical relationship between programs and the Strategic Outcome(s) to which they contribute.

Report on Plans and Priorities: Provides information on the plans and expected performance of appropriated organizations over a three-year period. These reports are tabled in Parliament each spring.

results: An external consequence attributed, in part, to an organization, policy, program or initiative. Results are not within the control of a single organization, policy, program or initiative; instead they are within the area of the organization's influence.

statutory expenditures: Expenditures that Parliament has approved through legislation other than appropriation acts. The legislation sets out the purpose of the expenditures and the terms and conditions under which they may be made.

Strategic Outcome: A long-term and enduring benefit to Canadians that is linked to the organization's mandate, vision and core functions.

sunset program: A time-limited program that does not have an ongoing funding and policy authority. When the program is set to expire, a decision must be made whether to continue the program. In the case of a renewal, the decision specifies the scope, funding level and duration.

target: A measurable performance or success level that an organization, program or initiative plans to achieve within a specified time period. Targets can be either quantitative or qualitative.

voted expenditures: Expenditures that Parliament approves annually through an Appropriation Act. The Vote wording becomes the governing conditions under which these expenditures may be made.

whole-of-government framework: Maps the financial contributions of federal organizations receiving appropriations by aligning their Programs to a set of 16 government-wide, high-level outcome areas, grouped under four spending areas.

Endnotes

i. **Ministerial Mandate Letters**, http://pm.gc.ca/eng/ministerial-mandate-letters
ii. **Minister of Innovation, Science and Economic Development Mandate Letter**, http://pm.gc.ca/eng/minister-innovation-science-and-economic-development-mandate-letter
iii. **Minister of Science Mandate Letter**, http://pm.gc.ca/eng/minister-science-mandate-letter
iv. **Minister of Small Business and Tourism Mandate Letter**, http://pm.gc.ca/eng/minister-small-business-and-tourism-mandate-letter
v. **Prime Minister of Canada's website**, http://pm.gc.ca/eng/ministerial-mandate-letters
vi. **Whole-of-government framework**, http://www.tbs-sct.gc.ca/ppg-cpr/frame-cadre-eng.aspx
vii. **2016–17 Main Estimates**, http://publiservice.tbs-sct.gc.ca/ems-sgd/esp-pbc/me-bpd-eng.asp
viii. **Supplementary Information Tables**, http://www.asc-csa.gc.ca/eng/publications/rp.asp
ix. **Future-Oriented Financial Statements**, http://www.asc-csa.gc.ca/eng/publications/rp.asp
x. **Tax Expenditures and Evaluations publication**, http://www.fin.gc.ca/purl/taxexp-eng.asp